THE

# ELECTRICAL REVIEW.

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## ELECTRICAL REVIEW.

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## THE STATUS OF THE ENGINEER.

AT the "mid-year convention" of the American Institute of Electrical Engineers, which was held in New York on February 17th, a number of papers were read on the subject above-named—a subject of perennial interest, which is well worthy of the attention which is periodically drawn to it both in America and in this country.

The paper read by Dr. E. W. Rice, jun., president of the American General Electric Co., is reproduced in the current issue of the *General Electric Review*, together with an excellent editorial on the matter under discussion.

The author of the latter draws a striking contrast between the ship-of-the-line of 1815 and the "super-dreadnought" of to-day, pointing out that in the former there was hardly a single mechanical appliance, except the pumps and the capstan, whereas the modern battleship is equipped with engines of 60,000 H.P. and upwards, and is a gigantic aggregate of engineering devices—"a most highly developed organism with man-made organs." He might have added that the very latest type, the U.S.S. *California*, is to be propelled and operated by electrical power; but for the purpose of his argument the definition of engineering is framed in the broadest sense, embracing not only the various branches of engineering as commonly understood, but also all scientific work in which educated men are engaged. At once this fundamental fact stands out—that whereas the admiral of old was himself well versed in every technicality of seamanship, the modern commander is absolutely dependent upon his engineers in the handling of his ship, the feeding, training, and firing of his guns, the discharge of his torpedoes, and every other major operation that takes place upon the ship in peace or war. Yet the admiral now, as then, is in supreme command, and it is only in recent years that the engineer has been accorded the rank of an officer—indeed, in the British Navy he has only been given full executive rank since the outbreak of the great war in which he is playing so essential a part.

The same general condition, the author continues, exists in all our industries; inception, development and successful operation are due to the engineer, who is the one indispensable factor without which progress would cease. "Yet he neither controls them nor dictates the policies of the thing of his own creation, and what is of more importance, he apparently is constantly seeing others reap the harvest for which he has so diligently sown." What is the cause of this phenomenon?

By way of explanation, the author suggests that when the engineer is really successful in the material sense, besides doing engineering work he becomes active in organising the work of others, and thus in time becomes a successful manager or business man, with greater financial rewards, and is lost sight of as the engineer. Again, in many fields his work has been so well done that other

less skilful can carry on the routine that he has laid down, and "the engineer has displaced himself by the product of his own brains. Indeed, in the field of operating engineers this is particularly noticeable, where the perfection of mechanical and electrical devices has been brought to such a state that the engineer holds much the same position as a lifebelt—for the greater part of the time he is not wanted, but when he is wanted his services are imperative if a disaster is to be avoided." Thus many men of good engineering training have to perform work which those with a less costly preparation could perform almost as well, and the result is necessarily dissatisfaction, not because the work is not congenial, but because the material reward falls so far short of that which corresponds to the expensive education and self-sacrificing labour of their younger days.

The author sees in this a danger for the future; if the feeling prevails that it is not worth a young man's while to enter the engineering profession, we are not going to progress in the future as in the past. "The engineering profession is giving more to the world than any other profession, and it is essential that it should be attractive to the young man of the future."

On the other hand, it is pointed out that there is another side to the question: in one sense the rewards in the engineering profession are far above those in most other professions. The engineer has the immeasurable joy of achievement. "It is the intense interest in striving for accomplishment that makes the engineering professions what they are, and has made the engineer the man of courage and resourcefulness, of patience and determination, of self-sacrifice and unending work." "The engineer must often have the idea that he is being exploited by others because of this very loyal devotion to work rather than to self-interest, and undoubtedly this has been the case in many instances," but the author sees hope for the future in the very fact that the engineer has changed the world to such an extent that nowadays commercial men have to know more of the engineer and his work, and this should lead to a more perfect understanding and a better material reward for the engineer. "Any factor in our great scheme of life that is so absolutely indispensable to our future progress must surely hold an enviable position in years to come."

Undoubtedly there is much truth in this analysis of the position of the engineer in the world's activities. That his merits are now beginning to be recognised by the public, we think, is as certain as it is that he is developing a divine discontent with his present position, and a healthy disposition to claim more adequate recognition of his rights. Both these tendencies are salutary and worthy of encouragement. The upper value of a man in the world's eye is usually limited by the value that he places upon himself; on the other hand, he must live up to or beyond his standard of value, if he wishes to maintain it. In the past, the engineer, as a class, has done the latter whilst meekly accepting the valuation placed upon him by the layman, who, being a business man, has not hesitated to take full advantage of his opportunities. It is for the engineer to remedy this state of things, and to assert his claim to an honoured position in the ranks of modern civilisation.

## THE MARKETING OF BRITISH GOODS ABROAD.

The question of how to market British goods abroad formed the subject of an address which was delivered at the Holborn Restaurant on April 9th by Mr. C. Hamilton Wickes, H.M. Trade Commissioner in Canada, who is Home on another of his welcome and profitable visits to this country, at a meeting of the Sales Managers' Association.

Mr. Wickes stated that British trade to-day was largely permeated with the leisurely ideas which prevailed in the eighteenth or nineteenth century, and these conditions were affecting the trade and commerce of this country at present. Changes had taken place in the meantime, but we had only recently recognised the necessity for reorganisation, without having, however, a clear conception of what we wished to reorganise and what we desired to effect by reorganisation. It was impossible for us to see ourselves as others saw us, because we spent the greater part of our commercial life in these small islands, whereas, in order to obtain a true conception of our shortcomings, we ought to pass more time in overseas markets, studying how our goods were selected in competition with foreign merchandise of the same character. It was essential to approach the problem with open minds, and prepare to discard our preconceived notions, and to start anew. As to the criticism passed on British manufacturers that they did not make articles to the particular design, stamp, or pattern required in a particular market, he mentioned that the last thing the Americans would do was to alter their patterns to suit anybody. But in the case of many articles made in the United States, it was found that they were also adapted to the requirements of other countries. The speaker had experienced great difficulty in getting information from those who complained of British firms not producing according to particular patterns; but where he had been successful in doing so, it turned out that the order had been offered either to a manufacturer who was months behind with his deliveries, or to one who was already working at full output. If the people who complained were asked why they did not approach other firms, they gave various reasons, including the assertion that other firms did not know the conditions in the Canadian market, and that they did not wish to approach an export agent. The reports of some of the United States Trade Commissioners attributed a great deal of the success of British trade to the credit which was extended to customers, but that applied to the merchants and not to the manufacturers.

Proceeding to consider the problem of the transportation service, the Commissioner asked whether it was not a fact that prior to the war Continental shipping companies could enter British ports and obtain as much cargo as they could carry, provided the rate was 6d. per ton less than the British rates. If a British company went to a Continental port could it get cargo on the same terms and conditions and have the same facilities for securing wharfage space? Perhaps that was one of the reasons why our shipping companies made arrangements with their Continental competitors to keep to the carriage of their goods so long as they did not come into British ports to transport British goods to foreign ports. The system of production in Great Britain was labouring

under many artificial restrictions. For instance, Australian buyers obtained a quotation f.o.b. from a British firm from a British port and a quotation from a Continental firm from a Continental port, but they wanted to know the cost laid down in Australia. Could they go to a British steamship company and ascertain the freight rate to Australia? They could go to any German firm and get a quotation for any commodity at once. Why did not the railway companies and the ocean steamship companies publish their rates? Why were German freight rates used in this country from German ports to oversea ports? The quotation for freight from Antwerp to Melbourne on a certain commodity by a German shipping line would be more or less approximately the same as from an English port to Australia. After referring to the control by foreigners of raw materials in our Colonies, as, for example, thorium, lead ores in Australia by Germans, and nickel deposits in Canada by Americans, Mr. Wickes suggested that it would be of advantage if a reform were made by the disclosure of the real names of the importers and exporters of goods where trade was entered in the names of agents, this being a measure of protection, as also was our system of weights and measures, against foreign competition in the home market, tariff or no tariff. It would also be of advantage if foreigners who commenced business here were registered as well as those who acted as agents or branches of foreign manufacturers.

If they proceeded from business done through retailers and dealt with articles which required demonstration, they entered upon a class of commodity which needed expert selling. If they took the view that there were no manufacturers who could compete with the British in quality, the necessity for expert salesmanship became more apparent. Approximately 70 per cent. of the goods exported from the United Kingdom passed through the hands of merchants; from 1 to 2 per cent. was distributed in foreign markets from the offices of British firms in this country, whilst the balance devolved upon oversea representatives. The merchants did not cover all the markets in the world; where they had no connection our foreign competitors—the Americans and the Germans—had had it all their own way. Where the merchant connection was small our trade dwindled or barely held its own, whilst that of foreign rivals rose to an astonishing extent. The conclusions arrived at were—(1) British goods reached a certain volume and value in a certain limited number of markets overseas by the help of the merchants; (2) the other markets were very slightly worked where there was not a connection, and few British goods reached them; (3) the larger volume of trade done in the markets with which merchants traded, obscured our weakness in relation to other markets; and (4) the merchant system had operated to enfeeble and atrophy the British manufacturer's power to sell.

The speaker proceeded to remark that unless British manufacturers sent out representatives to other countries they could not acquire the necessary knowledge of invoicing, freighting, packing, exchange, &c. They were in about the same position as foreign manufacturers held in the eighties of the past century when they started to undertake an export business. The question was, how they could get the information which their rivals secured and upon which they had since built up their businesses. If no attempt was made to travel, how could they get salesmen travellers? Perhaps the Americans were most advanced in that direction. The technical students in Canada were welcomed by the works over the border, where, after two years, they were transferred to the sales departments, and when they left the works they went away with the idea that no other firm could touch the manufactures of the works concerned. The Canadians said that if the British wanted their business they must go to them; if they did not go over the Canadians presumed that the British did not wish for their trade. If the volume of business transacted by one British firm was insufficient to warrant a representative proceeding to Canada, several firms should co-operate in appointing a joint agent to justify his devoting his whole time and attention to the business. That, again, presented difficulties from the standpoint of how the overhead expenses of running the office were to be paid by the firms using the agent, and a further obstacle existed where the agent was dealing with machinery and equipment, a business which ran into a considerable sum of money. The agent might be a good one who could secure a fair number of orders, but a limited capital of £15,000 or £20,000 only covered a few transactions in machinery.

Mr. Wickes, in conclusion, referred in detail to the suggested establishment in London of a general commercial staff—a Ministry of Commerce—and he suggested that the Admiralty, the War Office, the India office, the Crown Agents for the Colonies, &c., should come to some arrangement whereby periodical meetings could be held at which the Board of Trade might offer its experience, and at which an interchange of views might take place in regard to the purchases of materials and stores by these departments, the requirements in which were enormous. The proceedings concluded with a resolution urging on the Government and the Board of Trade the desirability of increasing the number of Trade Commissioners and pointing out the advantage to British trade to be derived from the frequent interchange of views between these representatives and business men in this country.

We trust that this expression of opinion will receive attention in the proper quarter. It seems to us that in any effort that the Government and the Board of Trade make to modernise and increase the efficiency of their relations to the trade of this country, they have at hand a particularly strong man in Mr. Hamilton Wickes.

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**Lead.**

Until the beginning of this week the Lead Market had held up pretty well, although the best point reached in the latter portion of last month had not been fully sustained. There had been a pretty fair inquiry which, in conjunction with the comparatively restricted offerings, partly owing to the stiff attitude of American holders, and to the shortage of tonnage available for moving lead from Spain to centres of demand, contributed to prevent much of a relapse in prices on the London market, but this has given place to a reluctant attitude on the part of buyers, and as soon as sellers showed a determination to dispose of a portion of their holdings there was a very rapid relapse. There had been a considerable amount of lead held by speculators, and this has been rather forced for sale, while the decline was accentuated on Monday, when English desilverisers came into the market. Although these interests did nothing in the way of pushing things unduly, they found it impossible to find buyers except at a very sharp reduction, and the decline compared with the previous trading was not far short of £2 a ton. It would appear that the English refiners had been receiving larger quantities of silver-lead from abroad, and that buyers seized the opportunity of standing out from the market in order to establish a considerably lower level of prices. Under these circumstances the present tendency of the market is one of some uncertainty, and with hardly anything doing for export the tendency will probably remain doubtful until some fresh feature develops. Meantime, however, the price has steadied and a fair upward reaction has been seen, while the feeling is more confident again.

It is a matter of considerable gratification that the absurd premium which was latterly established upon near

deliveries should have been cut down to such an extent as has been the case. The reduction in the premium was unquestionably due in part to the refusal of the Government to issue export permits. As soon as it became known that there were instances in which shipping permits had been refused, the market took on an easier tendency, and there can be no doubt that in any further upward manipulation the prime movers will have to reckon upon possible Government action tending to bring about, as far as possible, normal conditions. High premiums on early deliveries are against the best interests of the trade, and this is so in all cases. The frank recognition by the authorities of the position in this respect should act as a strict deterrent upon undue manipulation, and should have salutary effect in directions other than the lead market. It is expected that further heavy buying on Russian account cannot be long deferred, but the relative sluggishness experienced in this direction for some weeks past has been the cause of no little disappointment.

**Restraint of Trade.**

We have upon several occasions called attention to what is known as the "covenant in restraint of trade" which is to be found in so many contracts of service. For his own protection, the employer is often compelled to demand that those who enter into his service, and incidentally learn the secrets of his business, shall, for a time after leaving his employment, refrain from carrying on a similar business, or from entering the service of those who do so. *Primâ facie*, all such covenants are void as being in restraint of trade, and therefore contrary to public policy; but a long series of decisions in the Courts has modified the law so as to render enforceable, covenants which are reasonably necessary for the protection of the employer and not unduly harsh to the employé. An example of the class of case which often comes before the Courts is to be found in Herbert Morris *v.* Saxelby, which has been reported during its several stages in our pages, and was fully given in the *Times* of April 1st.

The plaintiffs were engaged in the manufacture of very special forms of machinery, including pulley-blocks, runways, and travelling cranes. Their business was a leading one in the United Kingdom in this class of machinery and extended over a large part of the United Kingdom. In March, 1911, the defendant entered into an agreement under which his salary was £3 17s. 6d. a week, and his engagement for two years certain. By Clause 7 of the agreement he covenanted with the plaintiffs that he would not—

**At any time during a period of seven years from the date of his ceasing to be employed by the company, whether under this agreement or otherwise howsoever, either in the United Kingdom of Great Britain or (*sic*) Ireland, carry on, either as principal, agent, servant, or otherwise, alone or jointly, or in connection with any other person, firm, or company, or be concerned or assist, directly or indirectly, whether for reward or otherwise, in the sale or manufacture of pulley-blocks, hand overhead runways, electric overhead runways, hand overhead travelling cranes, or any part thereof, or be concerned or assist as aforesaid in any business connected with such sale or manufacture.**

On leaving the plaintiffs' employment the defendant at once went into the employment of Messrs. Derome, the French agents of the plaintiffs, but in March, 1914, he entered the service of Messrs. Vaughan & Son, Ltd., Manchester, who were the principal competitors of the plaintiffs in the manufacture of some of the articles mentioned in the above Clause 7. Thereupon the plaintiffs brought these proceedings, claiming an injunction against the defendant substantially in the terms of this clause.

In these circumstances, Mr. Justice Sargant held that while the covenant was not unreasonable from the plaintiffs' point of view inasmuch as it was necessary for the purposes of their business, it would be wrong to enforce it against the defendant, as it would deprive him and the public of the benefit of the skill and experience which he had acquired while in the plaintiffs' employment, and prevent him using his knowledge. By a majority the Court of Appeal upheld this decision. The Master of the Rolls pointed out that restrictive covenants are usual in three cases:—(i) Where a trade secret requires protection; (ii) where the goodwill of a business is sold; (iii) where the liberty of a former employé is to be restricted. While they must be construed very strictly in (i) and possibly also in (ii) a greater freedom is to be exercised in (iii). In applying the older decisions to the facts of the present case, the Court was animated by the desire to prevent the defendant being deprived of the advantage of all his previously-acquired knowledge, and to relieve him from having to start the world afresh. The case emphasises the importance of consulting a lawyer before any document containing a restrictive covenant is signed.

**Wire Manufacturers and Development of the Overseas Trade.**

The present incapacity of the German wire-drawing firms to continue their shipments to the British Colonies and the South American States has, in the majority of instances, diverted the inquiries of these countries from German firms to British manufacturing houses, thus accounting in a large measure for the extreme pressure at present existing among wire manufacturers, &c., in this country, particularly in the copper section.

The neglect of the overseas trade in the past, and the great possibilities of development in this section, which the war has been the means of demonstrating, will doubtless result in a far wider outlook being taken by British wire manufacturers in the near future than has hitherto been the case. Until recently, no attention seems to have been paid to the development of the overseas trade, partly through the continued steadiness of home demands, but more particularly through the failure to appreciate to the full extent the enormous possibilities of the foreign markets.

It is interesting to note that of recent years great developments have taken place in the variety of the commodities shipped from the two great hardware shipping centres, Manchester and Birmingham. Until a few years ago the average Manchester shipping house concerned itself with little else but the shipment of cotton goods. Nowadays, practically every shipping house in the city has a hardware department, from which is shipped every description of hardware goods. This expansion of trade interests has been materially stimulated by the enterprise of the manufacturers themselves, who, in adopting the most up-to-date methods before placing their propositions before the shipping houses, have succeeded not only in inspiring the buyers to place the new commodity on their selling lists, but in encouraging them personally to supervise also the sending out to agents and travellers abroad the catalogues and samples submitted by the manufacturers. The catalogues, which become indispensable to the shipping house buyer by reason of the enormous amount of time and labour they save him, are usually printed in three languages, English, French and Spanish, and they bear no manufacturers' name; but the brand or trade mark, by which only the native mind identifies the goods, is a feature of great importance. The more distinctive and picturesque the brand or trade mark for goods sent, say, to the South American States, India, and most of the British Colonies, the better the prospect of the commodity being distinguished from all others by the native buyers, and consequently enjoying a greater preference.

If the manufacturer can stimulate the interest of the shipper, as he is almost certain to do, to send out his samples and catalogues to the agents and travellers abroad, he has accomplished what 99 competitors out of the 100 who do not supply these catalogues, &c., fail to do, without which enterprise no steady overseas trade can be expected to accrue.

In shipping to countries like Brazil, Mexico, and other such distant markets, it has been found, even by the largest manufacturers, that it is most beneficial to trade with these countries through a local shipper, who has his own agents on the spot to safeguard his interests, whereas the manufacturer, in the majority of cases, instead of receiving a 3 per cent. prompt cash settlement from the shipper, has to wait as long as 8 to 12 months for settlement, and very frequently, after having incurred heavy expenses, never gets his money at all.

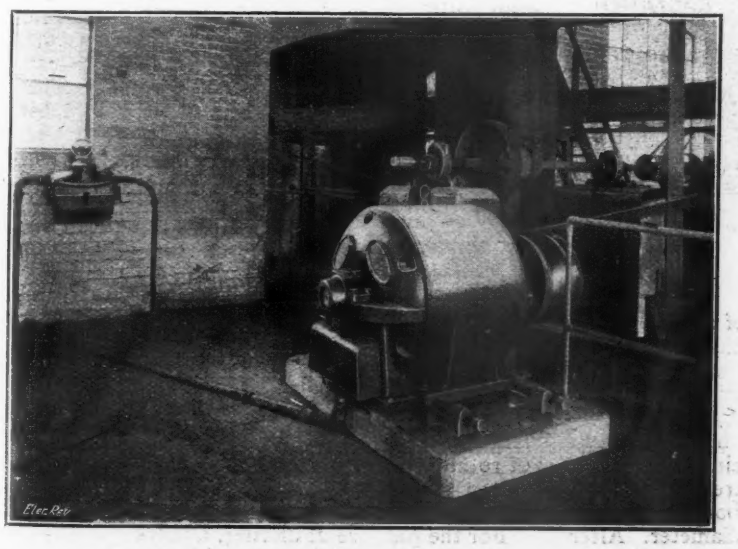
## THE CASE FOR THE ELECTRIFICATION OF PORTLAND CEMENT WORKS.

By ERNEST P. HOLLIS.

Portland cement is consumed in increasing quantities every year, and the rapid increase in consumption has induced considerable enterprise into the cement manufacturing world. New cement works are being laid down on every hand, and old ones are being modernised. The prospects for electrification schemes are therefore of the brightest, but the electrical engineer charged with the duty of approaching cement manufacturers with electrification proposals is often severely handicapped by a lack of acquaintance with the conditions obtaining in cement works, and especially the technical processes and terminology of cement manufacture. To the electrical engineer such terms as "kominor," "cylpebs," "silos," "slurry" and "dynamics" come as Greek, and a conversation with a cement works engineer in the vernacular of cement technology would be largely unintelligible to an uninitiated electrical engineer. It goes without saying that, if a cement manufacturer is to be approached on the electrification question, that electrical engineer will be the more likely to succeed who can converse with him in his own technical language, can understand his processes, and be able to convince the cement engineer that he (the electrical engineer) possesses an inside knowledge of the electrical requirements of a cement works.

Such a knowledge is difficult to gain. Even those electrical engineers who have occasion to visit cement works frequently on business bent gain very little insight into the technicalities of the process. Particularly is this so because the arcana of the cement world are usually guarded.

*Cement Manufacture.*—The primary ingredients of cement made by the wet process are clay, chalk and water, a mixture of which is thoroughly ground, then burnt in a kiln, and finally mixed with gypsum and ground again. Although the process wears a superficial air of simplicity, the technicalities are complicated, and there are very great differences in the qualities of the cements produced by various makers.



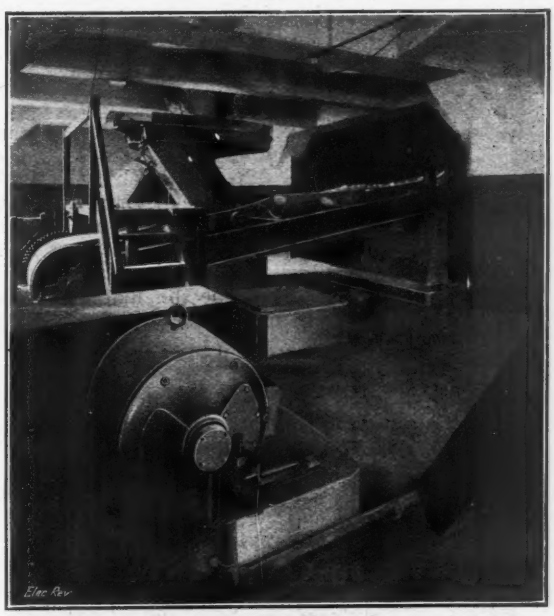

60 H.P. PIPE-VENTILATED MOTOR DRIVING COAL-CRUSHING PLANT.

There is also a dry process, largely used abroad, which is not dealt with here.

Viewing the process more in detail, it can be divided up for a typical modern cement works into four main stages in which the materials are treated:—

(*a*) The wet or raw mill. (*b*) The mixing pits.
(*c*) The kiln. (*d*) The dry or crushing mill.

In the electrified mill it is possible to make the process completely automatic, *i.e.*, from the time the ingredients of the cement enter the works to the time the final product leaves it, no occasion arises for manual labour. The functions of the employés resolve themselves simply into supervision and maintenance and no direct labour needs to be applied to the cement throughout the whole course of its manufacture.




15 H.P. PIPE-VENTILATED MOTOR DRIVING BAND ELEVATOR FROM SILO TO KOMINORS.

That large savings in wages and improvements in the quality of the cement accrue from automatic operation goes without saying, and the elimination of the human element assures a constancy in quality with the same ingredients that enables very delicate adjustments to be made to improve the operation of the plant.

*The Wet or Raw Mill.*—The four stages can now be discussed more fully for a typical mill. Naturally the details will vary in particular instances, but the following remarks apply to a large modern works.

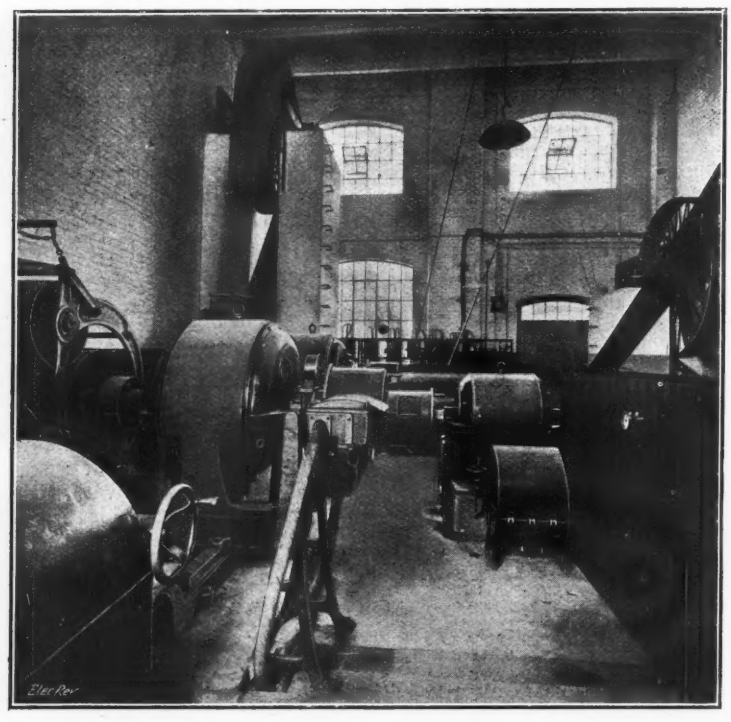
The chalk is tipped from a railway-siding—after the consignment has passed the scrutiny of the chemical laboratory—into a chalk intake or hopper, where it is met by a band or bucket elevator and lifted to the top of the building. This building is a strong, well-built brick construction, and has three stories. Arrived at the top of the building, the chalk is dropped into a "silo" or bunker. A word with regard to these silos may be opportune here.

In many stages in the cement-making process the silos are met, and their function is purely one of storage. The cement process is a continuous one, and a machine is never shut down except under compulsion. Compelling circumstances, however, arise; the mills need to be "topped up" with the grinding stones or boulders every week; the lining of the rotary kiln needs to be repaired; and so forth. Were there no storage available the stoppage of a single item of the plant would mean the shutting down of the complete unit. To preclude such a happening, arrangements are made for the storage of the mate-

rial at a number of points. If the wet mills are shut down, the kiln has a stock of slurry to draw upon; if the kiln be cut out of operation, the wet mills can still feed into the slurry storage pits, and the dry crushers can still draw upon the silos for clinkers.

Reverting to the silos, these have at their bottom an outlet which may be closed by a slide. From here the chalk is conveyed by a band conveyor, and, together with a mixture of clay and water, which has been previously mixed in a separate clay mill, it is discharged into the first of the rolling mills. At this stage the mixture is designated "raw slurry."

The mills usually employed are three in number, (*a*) the kominor, (*b*) the tube mill, and (*c*) the cylpebs. There are other types, but the three mentioned are mostly met in modern practice. The mills are usually installed in pairs, the raw slurry passing through them in the order named. A close understanding of the operation of these mills is important, for no matter what be the material to be ground—slurry, dry cement or coal—it usually goes through exactly the same process for crushing.



PIPE-VENTILATED MOTORS OF 250, 175 AND 60 H.P. DRIVING THE WET MILL.

The kominor mill takes the form of a large drum, and contains heavy steel balls about 6in. in diameter. From the kominor the slurry passes on to the tube mill by gravity. The tube mill consists of a long tube some 15ft. long, 4 or 5ft. in diameter, and contains pebbles and boulders. Again by gravity the slurry passes on to the cylpebs wherein the grinding process is finished. These cylpebs are drums some 12ft. in diameter, and containing about 12 tons of short lengths of iron bar about $\frac{3}{4}$in. diameter. After leaving the cylpebs the slurry is kept continually stirred in pits, from which it is drawn by the aid of slurry pumps up to the set of pits in which the mixing process proper is conducted.

*Mixing Pits.*—On emerging from the wet mill, the slurry, prior to its burning, undergoes a thorough mixing in order to secure a uniformity of consistency that is beyond suspicion. It is not sent into the main mixing pits, but goes first into the "correction basin" or "doctor pits." These pits derive their appellation from the fact that at this point the works chemist takes a lively interest in the composition of the slurry. His analysis lays bare any discrepancy in the constituents, which is remedied immediately in the wet mill. The next lot of slurry that comes along contains a preponderance of that constituent which is missing in the one under analysis, and the mixing of the two remedies the defect.

A mixing pit consists of a number of large concrete basins containing stirrers. Each stirrer is composed of a number of long arms radiating horizontally from a central rotating spindle, which rotates at a slow speed. Between the several pits is an intricate system of locks and sluices, so that any defective batch of slurry contained at that moment in the correction basin can be passed into one of the mixing pits and held up there until what may be called an antidote batch arrives. Between the correction basin and the main pits the slurry is transported by means of inclined screws revolving in concrete troughs. By these the slurry is screwed from one point to another. The mixing process is rather a long one, so that the pits have to have a comparatively large capacity. On the completion of the mixing process the slurry is pumped up and discharged into the rotary kiln.

*Rotary Kiln.*—The introduction of the rotary kiln, in addition to effecting an immense saving of time over the older burning methods, has opened a further field for the application of electrical power in a cement works. The kiln consists of a long tube, which may be 220ft. in length in the largest size and about 12ft. in diameter at the burning end. The smaller kilns are usually about half this length. It is slightly inclined so that the slurry entering at the top can descend by gravity, while the hot gases originating from the fire at the lower end pass upwards, and ultimately emerge into the atmosphere through a tall brick stack. The slurry and gases therefore pass in opposite directions. The rotating motion of the kiln ensures that every opportunity is given to the slurry to come in contact with the gases. The product of the kiln is a hard substance in fairly small pieces termed "clinker."

One cannot do other than admire the rotary kiln as an example of engineering construction. The stresses induced by the great length must be large, but added to this are the torsional stresses due to driving, to say nothing of those of expansion and contraction due to heating. It is agreeable to find that the design of these kilns has reached such a pitch that no trouble at all is experienced with them.

The kilns are only driven at one point; in the larger kilns this point is at the centre. The speed of rotation is not more than 1 R.P.M., the kiln being driven through belting and gearing, which is often capable of giving two speeds.

For the purpose of driving, a toothed rim is bolted on to the kiln which gears with the wheels. Naturally the latter must have very wide teeth in order to engage with those of the kiln-wheel when running at any temperature, the expansion and contraction being, of course, considerable.

After leaving the kiln, the clinker is passed on to a cooler which works in conjunction with the kiln. It consists of a miniature kiln with the exception that, instead of a fire, a current of cold fan-propelled air is passed through it for cooling the clinker.

As has been said, the kiln is fired by pulverised coal. This coal is blown into the kiln with a blast of air and gives a very high temperature, often attaining 3,000 degrees F. The coal is usually pul-

verised by a grinding plant exactly similar in nature to that used for the grinding of the cement. There are kominors, tube mills and cylpebs which grind the coal down to a very fine state.

A kiln of the large size described has an output of about 7.5 tons of clinker per hour, and rather less than one ton of coal is burnt per ton of clinker.

*Dry or Cement Mills.*—Leaving the rotary kiln and its cooler, the clinker, after being sprayed with water to "kill" any remaining uncombined line, next proceeds to the dry or cement mills, the most noteworthy characteristic of which is the immense amount of fine dust with which the atmosphere is laden and the floors covered. The transportation of the clinker from the cooler to the silos is done by a conveying plant.

In the ordinary way the clinker is drawn from the bottom of the silo into the crushing mills, which are an exact replica of the wet mills. Sometimes a kind of mill working on very much the same principle as the pug mills for mortar, which are commonplace to all building operations, takes the place of the kominor. Before passing into the kominor the clinker is mixed with gypsum, and the two are ground together. The final product passes on to the sacking machines which fill the sacks with cement. These sacks, by the way, have to be dried before being filled with cement, and for this purpose are dried by a current of warm air propelled by small electrically-driven fans.

*Economy of Electric Drive.*—The design of the modern works, scattered as it is over a large area with numerous points at which power needs to be applied, makes electrification eminently desirable. The introduction of the rotary kiln has done a great deal towards making electrification inevitable, for with its arrival the process could be made completely automatic. Generally speaking, the steam drive from a central point would be so inefficient as to make modern cement works operated on this principle commercially impossible. Even when steam is generated at a central point and distributed in an efficient manner to the various mills, the large number of small steam engines, which cannot remain unattended, involve a heavy prime cost and running charges, and raise the operating figures to a far higher point than those of an electrically-driven mill.

In addition to economies in the cost of power which are to be expected for the usual reasons from the installation of electrical plant, electricity offers in addition an easy method of determining the efficiency of the many mills, the power consumption of which up to the present has been shrouded in mystery. Taking as an example the tube mills, it has been found that one of these which had been taking 160 H.P. prior to electrification could have its power consumption, with the same quality of slurry, reduced to 112 H.P. by experimenting with different heights of pebbles in the mill. With steam plant it was impossible to obtain any accurate measurement which could be taken as an authoritative criterion of the power required by the mill. Naturally, in a cement works where dust is so prevalent, line shafting, which is inevitable in great lengths with steam plant, is to be avoided at all costs, and the individual electric drive permits considerable economy in this direction.

A great many of the operations in the cement works involve the transport of material from one point to another by belt conveyers, screws, and other methods. For this class of driving, the electric motor is invaluable, as it can be installed in out of the way places in which it would be extremely difficult to utilise a mechanical drive. A large number of electrically-driven cement works are now in operation, and satisfactory testimonials can be obtained from these works which will convince any cement works engineer in doubt as to the efficiency and convenience of the electric drive.

## WIRELESS CONTROL OF PUBLIC CLOCKS.

By ALFRED E. BALL.

Radiographic waves have proved of great service in the distribution of time over extensive areas, and will doubtless be pressed into the service of the horologist in many other ways; one of the most useful will, in the writer's opinion, be the wireless control, or rather supervision, of public clocks.

The scheme advocated, which has been put to a practical test by the writer, consists briefly in fitting each of the main public clocks in a town with a small wireless transmitting set, which would be operated periodically by the clock at definite times, and the installing of an official wireless receiving station, at which the various clocks would be checked daily. By means of this system each public clock would report its time-keeping, and in the case of any clock having an error greater than a certain small pre-determined value, steps could be taken at once to have it corrected.

The working of the scheme would be as follows:—

It is assumed that eight of the principal clocks of a town have been fitted with the automatic transmitting apparatus, which will be described later.

At the sound of an "attention" bell (arranged to ring shortly before 10 a.m.), the person deputed to "listen in" at the wireless receiving station (which we will assume, is installed at the Town Hall) receives the Paris time signal, from which he checks a standard clock, which should be provided with a seconds hand.

The error of the standard clock is duly noted in the clock rate book. He then moves the tuning slides of his receiving instrument to a position suitable for the reception of a 50-metre wave length which is marked on the coil, and listens for clock No. 1, which has been arranged to send its signal at 10.1 a.m. As soon as he has moved his slides to the

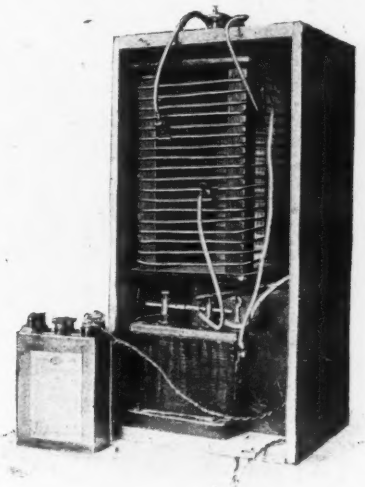


Fig. 1.

required position, he hears clock No. 1 sending a series of short "buzzes," which continue for, approximately, a minute, and terminate precisely when that clock shows 10 hours 1 minute a.m. By keeping his eye on the seconds hand of his standard clock while listening, he is able to note the error of clock No. 1 to a second, and this error is duly noted in the rate book in a space provided against the number of the clock.

No. 2 clock does not commence sending its signal until 10 hours 1 minute 40 seconds. The longer time has been given to clock No. 1 to give the operator ample time to tune in sharply and so get good signals. At 10 hours 2 minutes by No. 2 clock it signals its time by its last "buzz," and its error is also noted in the rate book.

Similarly the remaining five clocks are checked, the entire process occupying eight minutes, or, including the taking of the Paris time-signal, eleven minutes.

Means would be provided to enable the different clocks to be identified. The intervals of 40 seconds between the signals should be sufficient to prevent overlapping, as no public clock should have such an error. The signals can be repeated by the clocks at, say, 3 p.m., so that supervision may be exercised twice daily.

The writer has proved that, for the purpose in view, the wireless aerial may be quite unobtrusive, the apparatus simple and inexpensive, and the power small.

Fig. 1 is a photograph of the transmitting apparatus employed by the writer. This is a simple affair, contained in a box measuring 20 in. × 12 in. × 8 in., and is operated by a small 4-volt ignition accumulator which would last one month or longer with one charge.

Each turret clock to be supervised would require the following:—

(*a*) A transmitting apparatus as shown in fig. 1.

(*b*) Contacts fitted to the clock movement to *break* contact at a certain definite pre-arranged time.

(*c*) An aerial, which may be of an unobtrusive pattern.

(*d*) An "earth" connection, which may be the lightning conductor or a water pipe.

The connections of the apparatus to the contacts mentioned and to the aerial and "earth" are shown diagrammatically in fig. 2; incidentally, the movement shown is an electric "waiting-train" turret movement—now largely used for turret clocks—of which the writer is co-patentee with the makers,

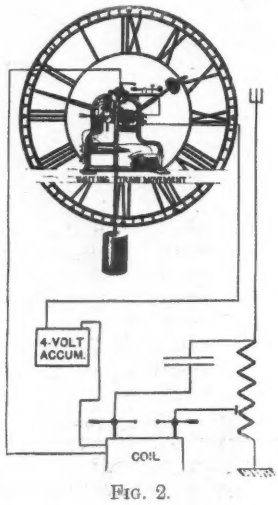



Fig. 2.

Messrs. Gent & Co., Ltd., of Leicester. The aerial in practice need only be a single wire; the one used by the writer in his experiments passed unnoticed up to the time of its removal on the outbreak of the war, and its length was 40ft. approximately. The separate "buzzes" are obtained by means of a contact operated by the pendulum at each swing, and the sudden cessation of the "buzzes" is produced by a contact in series therewith which is broken by falling off a cam fixed to, say, the centre wheel. In the case of a "waiting-train" movement, the spring which makes contact with the pendulum may be a fixed one, and may contact idly when not in operation, because the "interference" could not affect the timekeeping, but in the case of a mechanical movement this spring may be lifted out of the way by a cam when not in use, or brought into action by an electro-magnet only when required.

In the case of a striking turret clock the lifting cams (or pins), or the lifting lever, could be utilised for making the necessary contacts, the last "buzz" in this instance indicating the last blow of the hour struck. In checking the time of such a clock from the last blow, allowance would be made for its striking rate; thus—if the intervals were 3 seconds, the clock's actual time would be 27 seconds in advance of the last "buzz." This method of "contacting" assures that the striking is in order, as well as that the clock is to time. A town which desires to be "well-timed" should decide that, should any of its supervised clocks signal an error of more than 10 seconds, its custodian should be instructed to correct it forthwith.

The transmitting set shown in fig. 1 would be, in practice, completely enclosed in a dust-tight box, and as the only moving part would be the contact-breaker of the coil, little or no attention would be needed. In the event of the contact-breaker being out of adjustment, this would be indicated at the receiving station.

The writer has designed and made an instrument to enable a system of impulse clocks to signal its time-keeping to the receiving station, and therefore be supervised. This instrument consists essentially of a short and light pendulum, which is arranged to operate after the manner of a slow-ringing electric bell. One dry cell operates it, and its circuit is closed at pre-arranged times by contacts fitted to one of the impulse clocks in the circuit. The clock employed by the writer for the purpose was one made by his firm for ringing bells in a factory for the starting and stopping of work. The contact is closed for half a minute, and, in vibrating, the pendulum runs full tilt into contact with a spring at the end of each swing, thereby closing the circuit of the induction coil and producing a series of timed "buzzes" at the receiving station. By using pendulums of varying periodicities, different clock installations could be readily identified.

Fig. 3 shows diagrammatically the connections employed, which are self-explanatory. The relay

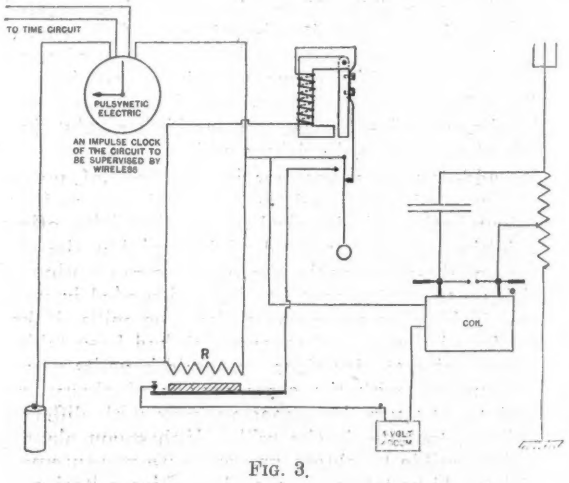



Fig. 3.

shown at R is necessary to break the primary circuit of the induction coil precisely at the end of the half-minute, and so terminate the "buzzes," because the pendulum, by its inertia, continues to swing and so touch the contact spring after the clock contact is broken.

Identification of individual turret clocks could be secured in many ways. First, the varying pendulum lengths could be taken advantage of when pendulum contacts are used, turret clock pendulums varying from 1 seconds beat up to 2 seconds or more in steps of ¼ second, and so the frequency of the "buzzes" heard would enable the clock to be identified, should it be considerably out of position on the schedule. Also, in the case of "striking" contacts, the frequency of the "blows," or rather "buzzes," would be a means of identification. Coupled with the foregoing features, a variation in the character of

the note can be employed by variations in the design of the spark-gap and contact-breaker.

The object of advocating the employment of the short wave length of 50 metres and small aerials is to ensure that the large commercial stations be not interfered with. Interruption or "jamming" would be possible from local amateurs with untuned apparatus, but, as amateurs usually only display their activity at night, trouble would not be experienced on this score.

Fig. 4 shows the receiving station used by the writer.

Before wireless supervision could be adopted, it would be necessary to get a licence from the Postmaster-General, who would specify the maximum

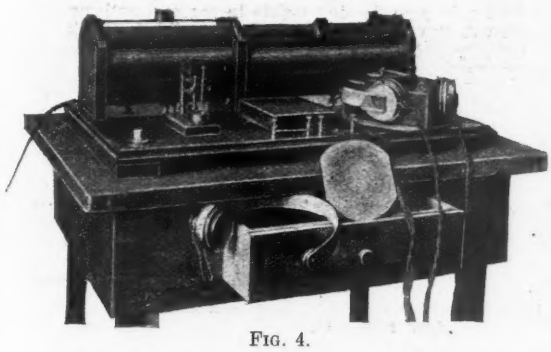


Fig. 4.

wave length which would be permitted, and also the maximum power to be employed. The requirements of this scheme are below the limits usually stipulated for.

An argument against the adoption of the scheme would be that, in the event of another European war, the scheme would be put out of operation by the suspension of the licence during hostilities. The writer ventures to assert that it will be a "long, long time" before Europe will again be brought under the spell of war.

## NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

In Kamloops, B.C., power to spend $80,000 for hydro-electric work is being sought. Yorkton, Saskatchewan, is noteworthy for the fact that some four years ago the first generator set driven by a Diesel engine in Canada was installed there; a second set, of 500 B.H.P., has recently been put into operation, the first one being only of 150 B.H.P.; provision has been made for three additional 500 B.H.P. sets. In isolated spots out in the West, Diesel oil engines would seem to be very suitable, as coal is very expensive, and under such conditions the advantage of having no stand-by losses for fuel is plain.

Prince Albert, Saskatchewan, has just put into operation recently an automatic telephone system, and in Crystal City, Manitoba, a new telephone company with a capital of $20,000 has been formed.

In Winnipeg, Mr. Leonard Andrews read a paper on "Automatic Electric Lighting Plants" before the Electrical Section of the Canadian Society of Civil Engineers a few weeks ago. This city has almost 40,000 H.P. installed in generating plant and another 5,000 KW. machine is being erected now. The station output is still growing, in spite of war conditions.

The last two completed turbines (water) were tested a little while ago after a 30-day continuous run. The makers had guaranteed 6,800 H.P. with a net head of 45 ft.; actually it is possible to obtain 7,200 H.P. with 80 per cent. gate opening under a head of 46 ft.

Several fresh places in Ontario have passed by-laws in favour of obtaining power from the Hydro Electric Power Commission of Ontario, and the farmers in various districts are becoming keenly interested in the possibilities of electricity on the farm as already applied by the Commission in a number of cases.

The agitation in favour of the so-called "hydro radials" (electric railways to be owned by the people, built and run by the H.E.P.C.) seems to be as strong as ever. A deputation representing many municipalities went to Ottawa a few days ago to ask for a Government subsidy, but owing to the war it was found impossible to get anything from the Dominion Government; an attempt is, however, to be made very soon to obtain a grant from the Provincial Government. In view of the enormous benefit to the community at large which, it is practically certain, would result from the construction of such lines, it is to be hoped that the deputation will meet with better success from the latter Government, particularly as it is more directly concerned than is the Government of Canada. The Provincial Government has just given the Commission powers enabling them to take over any electric railway in the Province. Tenders will probably be called soon for the installation of cables in certain streets in Montreal, where underground conduit has been laid, and an appropriation of $550,000 has been voted for additional conduit work.

That there are sometimes other causes operating to militate against a continuous supply of energy being given from a station driven by water power, besides transmission line troubles during sleet and other storms, is evident from the experience of the Ottawa Light, Heat and Power Co., which had last year to spend an additional $50,000 on coal owing to a period of exceptionally low water in the Ottawa River. A sleet and wind storm gave the Bell Telephone Co., the Quebec Railway, Light, Heat and Power Co., and the Dorchester Electric Co. a good deal of trouble a short time ago, when wires were brought to the ground and Montreal was without power or electric light for several days.

In spite of the war, the incorporation of new companies, particularly electrical ones, seems to go on much as usual. At the present time most engineering concerns appear to be taking up the manufacture of shells, large orders for which have been placed by the Government with very many firms; this is a good thing, as in many cases there is little or no other work in hand.

There are not many large steam generating stations in the portion of Ontario surrounding Niagara Falls, but the Dominion Power and Transmission Co., of Hamilton, is building a station designed for an ultimate capacity of 75,000 KW. Although one of the primary reasons for constructing this plant is to ensure continuity of supply, it is noteworthy that the steam plant is designed for continuous operation with a high fuel economy, conditions which add very considerably to the cost of a plant designed merely for stand-by purposes.

According to a statement emanating from the Department of Inland Revenue at Ottawa, Canada exports practically as much electrical energy as she makes use of herself; the figures for exported power and that used in the Dominion are:—

| Export. | Home use. |
|---|---|
| 772,597,049 KW.H. | 770,867,048 KW.H. |

These figures are for the fiscal year ending March 31st, 1914.

## INDIAN NOTES.

[FROM OUR SPECIAL CORRESPONDENT.]

*Bombay Mint.*—The plant in the Mint is to be shortly converted to electric drive and Captain Willis, R.E., is returning to Bombay to deal specially with this. He has been in control of the Calcutta Mint for some time back, where electric drive has been very successfully in operation for several years. The plant was provided by the G.E. Co., through their Indian agents, Messrs. Octavius Steele & Co., and has given extreme satisfaction.

*Calcutta Port Trust.*—The installation of Excello arc lamps in and around the docks and jetties of the Trust is one of the finest in India; but for the supply of carbons for the ensuing year—about 130,000 pairs—the Commissioners are in a quandary. As usual, tenders were invited early in January, 1915, but no satisfactory estimates were put forward; no firm would bind itself by the very strict conditions of supply required, and prices put forward were about double those of the previous years. It is believed, however, that a compromise has been effected and a tender has been accepted without binding penalties. If a satisfactory supply of carbons cannot be ensured the only alternative will be to substitute half-watt lamps of high candle-power later on.

*Electrical Engineer Volunteers.*—Probably 90 per cent. of the European electrical men in India are volunteers of one sort or another, although there are very few, if any, on active service. The Electrical Company of the Calcutta Port Defence Volunteers have been doing good work for months back under the able direction of Captain Stovold, of the B.I.S.N. Co., by way of manning the searchlights in the forts on the Hugli. Their work has slacked off considerably, however, since the *Emden* got her quietus; but while this aggressive little gunboat was roving about Indian waters the engineers, electrical and others, in charge of port and coast searchlights had a particularly anxious and trying time. Madras was without a port searchlight when the city was shelled by the *Emden*.

The Secretary of the Institution of Electrical Engineers sent out post-card inquiries some time ago asking for names of members on military service. Some misapprehension exists as to whether volunteers in active training are considered on active service or not. The majority of men interested favour the idea that the names of men only actively engaged on military operations either in Africa or Egypt or the Persian Gulf and elsewhere were required.

*Ban Kipore.*—This new capital of the recently constituted province of Behar and Orissa is growing rapidly in size and importance. Messrs. Gifkins & Co. are said to have got the concession for the electric lighting of the city and cantonments. Government House has already got its own installation, and the High Court and Post Office are both being installed with electric lights, fans, and lifts. Contractors are asking one another how it is that no tenders were called for before it was decided to give the work to a firm of Calcutta builders who are managing agents for a well-known electrical home firm. Such, however, is the way things are often done in India, and this very reprehensible practice is one which is growing, and one which should have the attention of the higher P.W.D. authorities. The amount of the contract in this particular case which was given away without asking for competitive tenders was approximately £5,000.

*War Effects.*—From the point of view of electrical engineering business, the war has made but slight difference up to the present. Contractors have their hands fairly full and there have been very few instances of firms diminishing their staff or workmen because of shortness of work. In fact electrical firms may be said to be more busy this year than for some time, and inquiries from Government P.W.D. and from military works departments have been very brisk indeed. Probably, however, a period of slackness may set in from April, 1915, as Government budgets run from April to the following March, and it is usual to expect a rush of inquiries and orders so that amounts previously budgetted may not lapse. As the current budget was passed in pre-war days and was fairly liberal, P.W.D. engineers are able to put through anticipated works. In the face of things at present, the coming Indian financial year is almost sure to be barren of important electrical or other works which are not an absolute necessity, and hence contractors who depend much on Government contracts can scarcely look forward to the year 1915-1916 as one with a rosy outlook.

## CORRESPONDENCE.

*Letters received by us after* 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

### Electric Vehicles.

*A propos* of your recent article on this subject, and of all current discussion, I failed to observe any suggestions and remarks regarding the application to that unostentatious vehicle known as the "Steam Roller." It would be interesting to hear of any investigation, municipal or otherwise, in this direction, and the conclusions derived therefrom.

Running and initial cost, also low radius of operation, may be points of discussion, but I think we can safely anticipate lower depreciation charges, and here at last is an instance in which the weight of the modern lead battery would stand as a decided advantage to the designer.

**L. G. Toplis.**

Glasgow, *April 12th*, 1915.

### Electric Cooking.

In a leaderette in your issue of March 19th you refer to my remarks at the I.E.E. on Mr. Cooper's paper, and I think your observations call for a reply from me. In stating that the matter goes beyond the scope of the Sub-Committee of the Engineering Standards Committee, of which I am chairman, you are, I think, unaware of the constitution of the particular Sub-Committee or "panel" dealing with this matter. On this panel are representatives of the I.M.E.A., Public Supply Companies, the B.E.A.M.A., the Electrical Contractors' Association, and the fire offices, so that it is difficult to see how it can well be more representative. I altogether fail to grasp on what grounds you apparently advocate the setting up of the I.M.E.A. as the proper authority to deal with the question; I should think that the supply companies, among which are to be found some of the most active workers in connection with electrical cooking, would have something to say on this matter. You are quite mistaken in supposing that the panel are in the least degree inclined to let the matter rest; on the contrary, they are actively at work on it, and they have the cordial co-operation of each one of the Associations which I have enumerated above.

Like most questions of standardisation, that of electric cooking apparatus lends itself to light and airy generalisations; but it is only those who have applied themselves to the actual work of evolving definite standards who apppreciate the real difficulties encountered.

**C. H. Wordingham.**

London, *April 5th*, 1915.

[We think it can scarcely be denied that, as the result of its extensive experience, and the fact that the great majority of our electricity supply undertakings are under municipal control, the I.M.E.A. is the most competent body to evolve a scheme which will enable consumers generally to obtain electric cooking apparatus on reasonable terms.

We fully appreciate the efforts that are being made by the Standards Sub-Committee, of which Mr. Wordingham is the chairman, and if they result in the consumer obtaining standardised and cheaper apparatus, so much the better. But it will be remembered that Mr. Wordingham, in discussing Mr. Cooper's paper, said with regard to the Sub-Committee that there seemed to be a great diversity of opinion as to the desirability of any standardisation whatever in connection with electric cooking apparatus, and that the manufacturers were not very eager for standardisation, from which we may justifiably assume that progress will not be very rapid.

On the other hand, Mr. Wordingham said he was strongly of opinion that there were certain things which might well be standardised, and in this we cordially agree with him.

Whether a representative Sub-Committee of the Engineering Standards Committee or a single-minded Committee of the I.M.E.A. brings about the desired result is immaterial, so long as that result is attained.—EDS. ELEC. REV.]

### Preferential Rates.

Referring to your leading article in the current issue of the ELECTRICAL REVIEW *re* "Preferential Rates," I should like it to be distinctly understood that it is not I, as the acting engineer and manager, that will not accept photographic work at the lowest possible price. I am out for all the day load I can get, at the lowest remunerative price, and what is more, I am getting it, for, as a matter of fact, our output for the past four weeks has been greater than for the corresponding four weeks in any year since the commencement of the undertaking, notwithstanding the fact that the Shop Hours Act has recently been put into force here, and the licensed premises are closed at 9 p.m. instead of 11 p.m. as formerly. Moreover, Ilkeston is not a town which is being blessed with war orders.

**G. H. Browne,**

*Acting Engineer and Manager.*

Ilkeston Tramways and Electricity Department,
*April 10th*, 1915.

[We hope we did not convey the impression that the engineer was in any way responsible for the trouble at Ilkeston; our previous report indicated that the Committee was divided on the point. We congratulate Mr. Browne on his progressive policy, with which we are heartily in sympathy.—EDS. ELEC. REV.]

### Water Heating by Electricity.

In view of the publication in your columns last week of a letter from Mr. George Wilkinson, in which he says that the *Journal of Gas Lighting* "grossly misrepresented" his recent statements on the subject of electric water heating, I shall be glad if you will kindly publish in your next issue the editorial note which was attached to Mr. Wilkinson's letter when it appeared in our columns.

**The Editor,**

*Journal of Gas Lighting.*

London, E.C., *April 9th*, 1915.

[In the note referred to, Mr. Wilkinson is described as "uncharitable and thin-skinned," and the reports of his remarks in the electrical Press are quoted in support of our contemporary's criticism. We do not consider the matter of sufficient interest to reproduce the lengthy note in full.—EDS. ELEC. REV.]

## ELECTRICITY EXTENSIONS AT CARLISLE.

THE municipal supply of electricity in Carlisle dates from 1899, when the original scheme, costing some £30,000, which was installed under the direction of Prof. Kennedy, was opened.

From time to time extensions have been carried out on the direct-current system, but within the last year or two, owing to the extended distribution in prospect and the growth of the power load, and the fact that the next plant required would be of the high-speed turbine type, it was decided to introduce three-phase alternating-current supply, and to meet immediate requirements by installing two motor-generators to supply beyond the economical limits of the original direct-current system. This initial scheme was followed by a more comprehensive one, involving loans of £23,940 for plant and £6,000 for mains, and necessitating the extension of the engine room and provision of a 1,250-KW. turbo-alternator, with surface condenser and wet air filter, two 600-KW. rotary converters, H.T. and L.T. switchgear, circulating water piping, &c., a new boiler, and additions to the lighting battery. All the available building space has now been covered, and space is provided for two additional 1,250-KW. turbine sets, while foundations have been laid down for a fourth water-tube boiler.

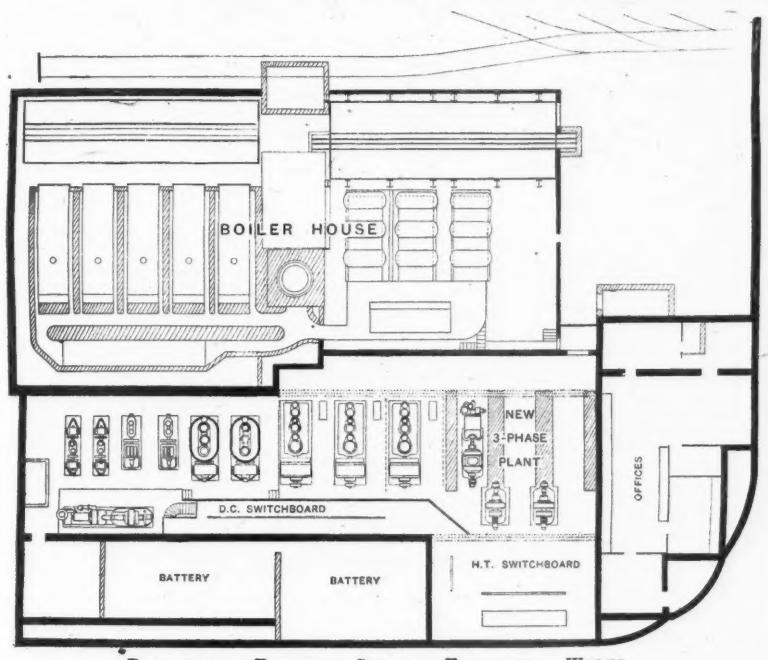
The station now affords accommodation for generating plant sufficient for some years to come, and the boiler power can be increased by substituting water-tube boilers for the older Lancashire boilers; the only difficulty appears to be a possible shortage of cooling water for condensing in the summer, when the adjacent River Caldew is very low.

In 1911 the Council was empowered to supply any place within two miles from the centre of the city, and in 1914 a further special order was made allowing supply to certain houses in the Scotby district; the Stanwix area has been changed over from direct to

alternating supply, and all new large power consumers are to be supplied on this system.

The principal features of the new plant are as follows :—

The turbo-alternator was supplied by the Oerlikon Co., and is of the Rateau type, running at 3,000 R.P.M., and of 1,250 KW. capacity, for supplying three-phase 50-cycle 3,000/3,300-volt current. A steam-driven stand-by oil pump is provided for lubrication purposes at starting, the ordinary pump for this and for




Plan of the Extended Carlisle Electricity Works.

supplying the oil-controlled relay governor being direct-driven from the turbine shaft.

A separate exciter is direct-coupled to the alternator shaft, and an Oerlikon automatic pressure regulator is mounted on the switchboard.

The wet air filter for the alternator is of the Heenan and Froude type, while the main condenser is of Worthington rectangular pattern; no isolating valve is fitted between it and the turbine, but arrangements have been made for flooding the condenser so as to permit of temporary exhausting to the atmosphere. Motor-driven circulating and rotary air pumps are provided, driven from the D.C. bus-bars and arranged for automatic change-over to the battery in case of emergency.

The two 600-KW. rotary converters were supplied by the British Westinghouse Co., and are of the six-phase type running at 750 R.P.M. The converters are arranged for direct-current starting only, and are available for giving either direct-current lighting or traction supply or for running inverted from these supplies and delivering three-phase current.

A special exciter and a synchronous booster are mounted on the shaft of each machine, and each of the latter is supplied through a 660-K.V.A. British Westinghouse oil-insulated self-cooled transformer.

The new switchgear, which has been supplied by the same firm, is situated on a gallery in a recess on one side of the extended engine room.

The recess backs on to the street, and the H.T. feeder cables are brought direct into the switch cubicles.

The switchgear consists of an operating board with panels for two rotaries, two turbines and two feeders, and spare panels for an additional rotary and turbine set; behind are the moulded stone cubicles containing the bus-bars, oil-switches, instrument transformers, &c., the cells being arranged back to back.

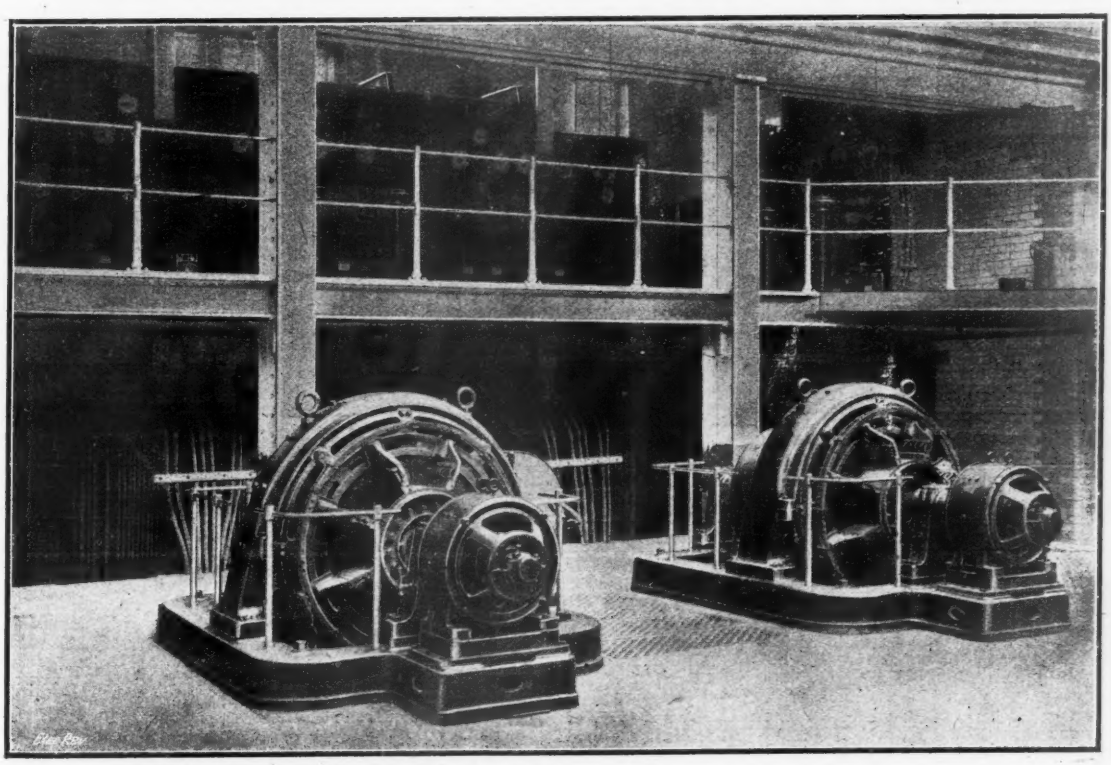
The direct-current board for the rotaries is connected to the old switchboard by bare copper strip, and access to the old switch gallery is also provided.

The cost of the original plant at Carlisle, some £30,000 for 370 KW., was, roughly, £81 per KW.; the completion of the present extension, giving a plant capacity of 3,920 KW., brings the figure down to £33 per KW., and with the further additions provided for, with some 6,420 KW. installed, a further drop to £23½ per KW. will occur.

During the year 1913-14 the undertaking generated 3,759,645 units and sold 3,140,457, of which some 2,360,000 were for power and heating supplies—the latter to over 3,000 H.P. of motors and about 114 KW. of heating and cooking plant.

There were some 760 consumers, with 55,000 30-watt lamps, connected to the mains; also 57 public arc lamps, and some 290,000 units were supplied for traction purposes.

Ever since the Corporation supply of electricity commenced the revenue has steadily grown, and prior to 1913-14, when there was a small deficit on the working, considerable net profits were earned for many years. It may be noted, however, that during the years 1912-13 and 1913-14 over £5,000 was expended out of revenue on



Westinghouse Rotary Converters and H.T. Switchgear, Carlisle Electricity Works.

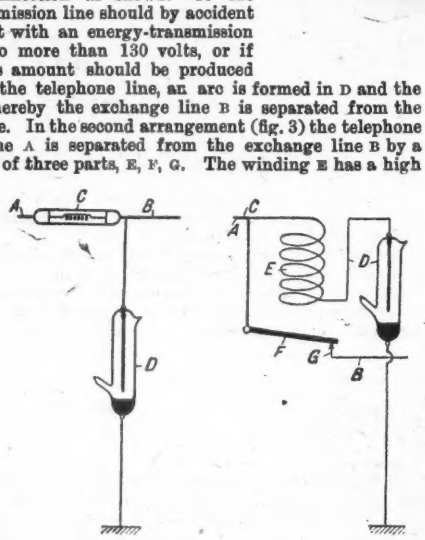
plant and alterations, and the results must be judged accordingly. In conclusion, we are indebted to Mr. F. W. Purse, the City Electrical Engineer, for the particulars here given.

## NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

### Vacuum Tubes for Telephone Line Protection.

Carbon lightning arresters protect against voltages above 3,000. To protect telegraph and telephone lines against lower voltages, vacuum tubes are used and are of excellent service for protection against voltages above 300. In the *E.T.Z.*, F. Schroeter describes a new form of vacuum tube which is effective down to 130 volts. The construction is shown in fig. 1. The anode *a* is an aluminium pin surrounded by a protective tube *b*. The lower end of the anode *a* is at a distance of a few millimetres from the cathode *c*, which is a fused alloy of potassium or sodium. Current is supplied through platinum wires *d* and *e*. The tube is filled with helium, neon, argon, or a mixture of these gases at a pressure of from 1 mm. to 3 mm. The life of the tubes is practically unlimited. A tube will withstand thousands of breakdowns without change of its critical voltage. This vacuum tube may be used with the connections of either fig. 2 or fig. 3. In the first case, the fuse C (operating at about 0.5 amp.) is inserted between the telephone transmission line A and the exchange line B. The vacuum tube D is inserted in an earth connection as shown. If the telephone transmission line should by accident get into contact with an energy-transmission cable charged to more than 130 volts, or if voltages of this amount should be produced by induction in the telephone line, an arc is formed in D and the fuse C melts, whereby the exchange line B is separated from the transmission line. In the second arrangement (fig. 3) the telephone transmission line A is separated from the exchange line B by a relay consisting of three parts, E, F, G. The winding E has a high resistance, say, 8,000 ohms to 15,000 ohms. When a dangerous voltage occurs, a brush discharge takes place in the vacuum tube D (because the high resistance of E prevents the currents reaching an intensity sufficiently high for the evaporation of the cathode which would produce an arc). The current passing through E excites the relay and attacks the armature F, so that the contact between A and B is broken. The interruption lasts as long as the dangerous voltage in A, and stops automatically when the dangerous voltage disappears. By artificial means it is possible to devise vacuum tubes which will operate below 110 volts. For instance, if *a* is used as the cathode, the surface being covered with a layer of potassium, and a distance of 5 mm. is employed between *a* and *c* with a gas mixture of two-thirds neon and one-third helium at a total pressure of 2 mm., the break-down E.M.F. is 104 volts. A variation in the width of the vacuum tube has an effect on the critical voltage.—*Elec. World.*

Fig. 1.—Vacuum Tube.




Figs. 2 and 3.—Wiring Connections in Vacuum-Tube Protective System.

### Higgs Motors.

In a new list Messrs. Higgs Bros., of Sherbourne Road, Balsall Heath, Birmingham, describe a range of standard D.C. motors and generators which they are building. We illustrate the component parts of one of these in fig. 4. The machines are of the protected type, with armature cores of Stalloy, and former-wound coils. The brush-holders are of the sliding-box type, of neat and compact design, and Hoffmann ball-bearings are used throughout. The machines are designed to carry 25 per cent. overload for one hour, and to have a high efficiency; they range in size from $\frac{1}{16}$ H.P. to 25 H.P. An ingenious system of listing shunt generators is employed, which enables a purchaser to select a machine to suit his requirements exactly, the output of a given frame being ascertained by multiplying the desired speed by a constant.

The firm has been established about three years, during which time it has turned out upwards of 3,200 motors, and it is now building them at the rate of 2,500 per annum; the very first machines made are interchangeable with those it is supplying to-day in every respect. We understand that the firm has had very few complaints indeed, while the actual number of rejections has been only three. Owing to their using a special material in the manufacture of commutators, the makers have never had a single complaint as regards the mica giving trouble; they have never had a bearing complaint, and have not yet replaced a single bearing, although some of the machines have run as fast as 7,000 R.P.M. They now fit terminal blocks on all their machines, a feature which is not mentioned in the list They regularly have in stock or progress 300 to 400 motors.

The firm has already had to extend its premises twice, making them three times the original size, and further large extensions are anticipated in the near future.

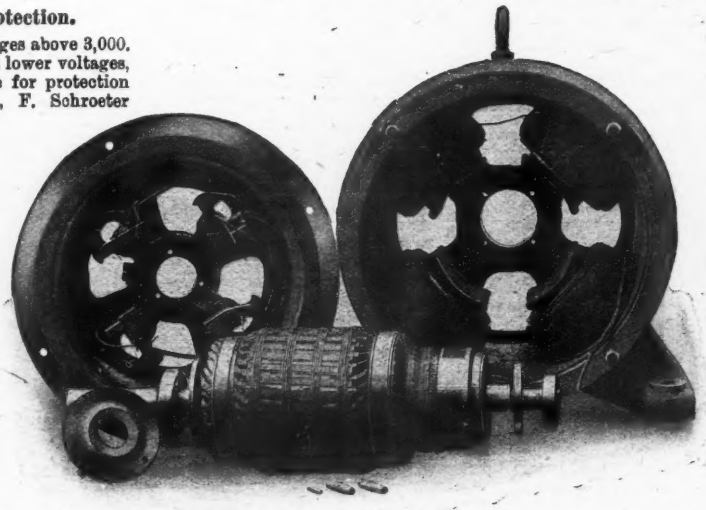


Fig. 4.—Component Parts of Higgs Motor.

### High-Power, High-Pressure Water Rheostat.

In testing modern generating sets, it is frequently desirable to provide a large artificial load, conveniently regulable over a wide range and, particularly when it is desired to test prime mover, generator and transformer as a complete unit, suitable for use in high-pressure circuits. Where pressures of 10,000-20,000 volts or higher are concerned, special care in design is required to secure a reasonably compact rheostat, safe to handle while in use and offering sufficient resistance to provide 1,000-2,000 KW. or greater load. Water rheostats offer the best solution to the problem, long water channels of small section being used to provide resisters of sufficient resistance and current-carrying capacity. Electrodes placed at the points of a triangle in a cooling pond do not form a convenient equipment, and, moreover, the water constitutes almost a short circuit, unless it be exceptionally pure or the electrodes are very far apart and the pond is shallow. The accompanying illustrations, reproduced from the *Electrical World*, show the construction of a water rheostat found suitable for 250 to 2,500 KW. three-phase load at 20,000 volts, using water of exceptionally low specific resistance, viz., 100 to 200 ohms per inch cube. By modifying the proportions of the water channels, adhering to the same general design, wide load variation can be provided at almost any voltage.

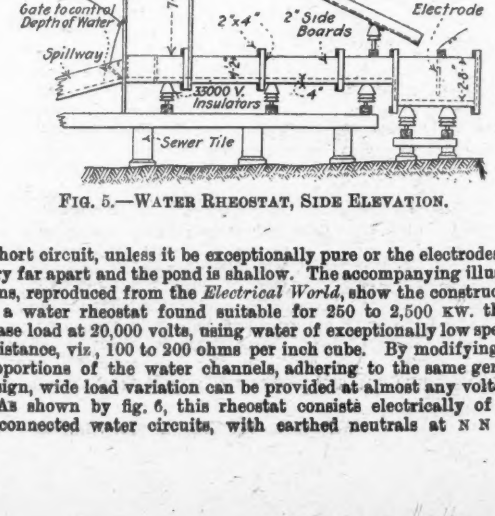



Fig. 5.—Water Rheostat, Side Elevation.

As shown by fig. 6, this rheostat consists electrically of two Y-connected water circuits, with earthed neutrals at N N and

high potential phase points at A, B, C. Each leg of the rheostat is supplied with water through 50 ft. of two-inch cotton fire hosing, discharging into a steeply inclined open launder as shown in fig. 5. The pipe header supplying the cotton hoses is fed at each end by a two-inch service pipe, and is provided with a separate valve on each outlet. This header is earthed, and the water resistance between it and each of the points A, B, C is about 8,000 ohms, even using water of only 200 ohms per inch cube specific resistance. The converging rheostat troughs are 21 ft. by 18 in. square, ample depth being provided to prevent water boiling over and thus establishing an earth fault. Since the water boils or nearly boils in service, the troughing must be of fairly heavy timber and firmly strapped together. For the same reason, evaporation and consequently changes in density and specific resistance are apt to be high, hence the water supply valves in the pipe header should be kept open as far as possible and load balancing effected by adjusting these valves, and thus the water density and resistance in

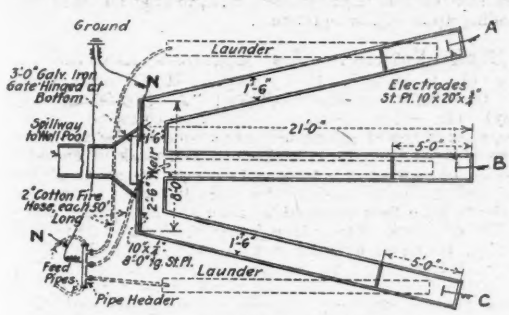



FIG. 6.—WATER RHEOSTAT, PLAN.

each rheostat channel individually. The load as a whole is varied by means of the cord and hinged gate in the discharge weir from the neutral electrode box (see fig. 5). In the rheostat as illustrated, provision is made for load balancing by adjusting the positions of the electrodes A, B, C, but control by regulating the water supply is preferable and perfectly satisfactory. The water hose and flume are insulated; the whole rheostat is carried on 33,000-volt, pin-type insulators, and the only two points needing to be handled during operation (viz., the water valves and discharge gate) are permanently earthed. A cord can be carried from the discharge gate to the meter house test bench, and the water control valves can be located at the same spot. Only a limited supply of water is required; it may be rich in salts and therefore of low specific resistance, and can be used again and again with only the loss due to evaporation. Knowing the resistance of the water, the circuit voltage and the required load, it is easy to calculate the necessary rheostat trough and supply pipe dimensions to meet other conditions than those to which apply the data given in the above illustrations.

# LEGAL.

### NOISE AND VIBRATION CAUSED BY ELECTRIC PLANT.

IN the Chancery Division, on Tuesday, before Mr. Justice Eve, the Worksop and Retford Brewery Co., Ltd., moved for an injunction restraining the Worksop Palace, Ltd., from creating a nuisance by the noise and vibration caused by the electric plant on their premises. Mr. Jessel, K.C., said the plaintiffs were the owners of licensed premises adjoining the defendants' property. He understood the motion was now assented to by the defendants, and he asked that it should be treated as the trial of the action and a perpetual injunction granted. Mr. Dighton Pollock, for the defendants, agreed. His Lordship granted a perpetual injunction against the defendants.

### CUNNINGHAM, LTD.

IN the Companies' Winding-up Court, on Tuesday, Mr. Justice Astbury heard the petition of W. T. Henley's Telegraph Works, Ltd., for a compulsory order to wind up Cunningham, Ltd., electricians and electrical engineers. Counsel stated that creditors for considerably over £2,000 had agreed to an arrangement in the matter, but creditors for an amount of about £100 were now standing out. It was possible that they might also agree to the arrangement, and he therefore asked that the petition be allowed to stand over for another week.

Counsel for the opposing creditors consented to the adjournment, and his Lordship directed the petition to stand over for a week.

**War Maps.**—MESSRS. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., of Blomfield Street, London Wall, E.C., have issued a pocket war map booklet illustrating the various war areas in Europe. Copies will be sent to electrical readers on application.

## WAR ITEMS.

**U.S. Electrical Exports in January.**—The following data on the electrical exports of the United States for January are published by the American "Electrical Review and Western Electrician" from the government report on the foreign commerce of that month issued by the Bureau of Foreign and Domestic Commerce. The total value of electrical shipments in January was the highest since last May, but was nearly 10 per cent. below the total of the corresponding month a year ago. In the four classes for which numbers of articles exported are given, there were shipped in January: electric fans, 1,278; arc lamps, 35; carbon-filament lamps, 51,825; metal-filament lamps, 189,848. In the following table are given the detailed figures for the various classes reported. Corresponding figures are given for last January and for January, 1914:—

| | Jan. 1915. | Jan. 1914. |
|---|---|---|
| Batteries | $ 100,946 | $ 43,892 |
| Dynamos or generators | 309,868 | 199,046 |
| Fans | 17,221 | 43,236 |
| Insulated wire and cable | 83,728 | 174,321 |
| Interior wiring supplies, etc. (including fixtures) | 72,104 | 46,452 |
| Lamps— | | |
| Arc | 759 | 9,204 |
| Carbon-filament | 5,802 | 13,910 |
| Metal-filament | 38,504 | 21,840 |
| Meters and other measuring instruments | 40,556 | — |
| Motors | 205,140 | 346,782 |
| Static transformers | 57,122 | 128,788 |
| Telegraph instruments (including wireless apparatus) | 17,326 | 12,788 |
| Telephones | 184,556 | 70,265 |
| All other | 640,306 | 837,122 |
| Total | $1,773,938 | $1,947,646 |

**An Austrian Company and the War.**—The report for 1914 of the Felten & Guilleaume A.G., of Vienna, states that the working results were unfavourably influenced by the consequences of the war, although sales considerably declined in the first half of the year owing to the restriction to a minimum of the orders placed both by the government and municipal authorities as well as by industrial undertakings. After the war broke out a complete stoppage, except for orders for army purposes, took place in the cable department, but in the further course of time a demand was again manifested, the Vienna Municipal Council in particular having given large orders. The difficulties in the way of procuring raw materials, and the dearness of these, largely increased the cost of production and diminished the earnings. On the other hand, the iron and steel works in Styria found ample compensation in the great requirements of the Army authorities for the deficiency in the normal class of business. The accounts show gross profits of £106,000, as contrasted with £144,000 in 1913, and net profits of £57,000, as against £92,000. It is proposed to pay a dividend of 10 per cent. on the ordinary share capital of £354,000, as compared with 15 per cent. in the previous year. The directors state that, although no definite opinion can be formed as to the business prospects for the current year, they believe that after the termination of the war exceptionally large requirements will be experienced for the re-establishment of destroyed values and the replacement of stocks which have been entirely exhausted.

**Opportunities for Manufacturers in Russia.**—A correspondent of the "Electrical World" states that the opportunities for electrical trade are great in Russia, but it is not a simple matter to secure and develop the trade. The most densely populated parts of Russia, starting from the Gulf of Finland, are the cities of Revel, Riga, Windau, Libau, and Mittau. Most of the people are of German and Scandinavian descent, and prefer to talk German rather than Russian. The people living between Mittau and Warsaw are of Lithuanian and Polish descent, and do not like to talk Russian at all, because they hate Russians and the Russian language, so that one must use German if he wishes to transact business with them. Most of the apparatus in service is operated at 110 volts or 220 volts direct current, except the street railways, which are 500-volt systems. A small part of the apparatus is of English make. American goods are considered superior, but the people know very little about them. For American manufacturers wishing to open offices for consulting engineering or sales work in Russia the best location is Riga or Petrograd. The office should be put in charge of a Russian-American who is familiar with Russia and her people and with American advertising.

**Rifle Shooting.**—Like most other districts, Merrie Islington has its Civic Guards, and a site for their rifle practice has been offered, free of charge, by Messrs. A. P. Lundberg & Sons, adjacent to their works, which are practically in the centre of the borough.

**Board of Trade Assistance.**—The Commercial Intelligence Branch of the Board of Trade has issued its weekly list, to April 3rd (No. 15), of inquiries for sources of supply of goods.

**Munitions of War.**—The following are the terms of a resolution, passed by the undernoted societies on Sunday last, with respect to the production of munitions of war:—"We, representing the trade unions in the shipbuilding and engineering trades of the North-East Coast, welcome most heartily the establishment of a committee on which the working men, the employers, and the Government departments are represented. We do not want any more speeches about the failings of the workers, the employers, or the Government; we want to pull together and get on with it. You may tell Lord Kitchener that we shall deliver the goods. The working man of the North-East Coast will do his bit." The societies concerned are:—Associated Blacksmiths, Boilermakers and Iron and Steel Shipbuilders, United Brass Founders and Finishers, Amalgamated Cabinetmakers, General Union of Carpenters and Joiners, Northern Enginemen's Association, Amalgamated Society of Engineers, Electrical Trades Union, Gas Workers' and General Labourers' Union, National Amalgamated Union of Labour, United Machine Workers, National Amalgamated Union of Painters and Decorators, United Patternmakers, United Operative Plumbers, Ship Construction and Shipwrights' Association, Sheet Iron Workers' and Light Platers' Society, United Kingdom Society of Smiths and Strikers, Amalgamated Society of Woodcutting Machinists, Ironfounders' Association, Steel Smelters, and Amalgamated Society of Carpenters and Joiners.

**Municipal Workmen for Armament Factories.**—The appeal of Lord Kitchener for the Birmingham Corporation to release as many men as possible from its services, in order that they may be employed by the Government in the manufacture of munitions and other war requirements, has received full consideration, as a result of which the Lord Mayor of Birmingham has issued a statement in which he shows that, while speedy compliance is not easy, seeing that a large number of the Corporation's employés are already serving with the Colours, it can, by the exercise of care and the re-organisation of duties, spare 1,062 men, taken from the following departments:—Public works, 233; gas, 200; water, 57; electric supply, 5; lighting, stables and refuse disposal, 165; parks, 48; public health, 20; estates, 9; asylums, 1; tramways, 311; education, 13. Of the large number already serving with the Colours (2,615 out of 15,267, or 17 per cent.) 155 (out of a total of 701, or 22 per cent.) are from the electric supply department, and 895 (out of a total of 3,430, or 26 per cent.) are from the tramways department.

**Germans at Shanghai.**—The "Times" correspondent at Shanghai states that British shareholders there are making a determined effort to unseat all German directors of British companies. "The feeling is strong that in order to uphold British prestige the Government should definitely declare trading with enemy subjects in China illegal."

**Enemy Goods for Australia.**—An Australian paper just to hand states that about the middle of February a large quantity of machinery, addressed to the Sydney Municipal Council, was detained by the Customs authorities on the ground that it was enemy goods. The machinery was taken to Sydney in the "Annam" from Copenhagen.

**Roll of Honour.**—Private Geo. Riley, of the 4th Liverpool Regiment, who has died from wounds received at Neuve Chapelle, was formerly employed by the National Telephone Co., at Stockport. He was 19 years of age.

Intelligence has reached St. Albans of the death at the front of Mr. Frederick Vicary Smith, who was an electrical engineer at the North Metropolitan E.P. Supply Co. at Camp Field, St. Albans. Deceased, who was in his 23rd year, went to France on Christmas Eve with the Herts. Regiment. He was buried in the town cemetery of Bethune.

**Personal.**—Mr. W. E. Miller, one of the representatives of the electrical cooking and heating department, of Carron Company, has been granted a commission in the 16th Battalion Highland Light Infantry. Since the war commenced, about 60 per cent. of the staff of this department have enlisted.

## BUSINESS NOTES.

**Catalogues and Lists.**—Messrs. Igranic Electric Co., Ltd., 147, Queen Victoria Street, London, E.C.—Pamphlet No. 623 (reprint), describing the firm's new push-button system of control for printing machinery.

Mr. G. Braulik, 8, Lambeth Hill, Queen Victoria Street, London, E.C.—Leaflet describing the "Express" electric lamp fixer for changing metal-filament lamps from 10 to 100 c.p.'s in their sockets by a patent grip, which works in conjunction with a special wooden support.

The British Thomson-Houston Co., Ltd., Rugby.—Descriptive list No. 2,213 on B.T.H. type D.H. continuous-current generators up to 150 kw.

Messrs. Hollings & Guest, Ltd, Thimble Mill Lane, Birmingham,—40-page catalogue containing brief descriptive notes concerning, and illustrations of, their hydraulic presses, pumps, accumulators, valves, &c., for all purposes.

Messrs. J. H. Holmes & Co., Newcastle-on-Tyne.—Illustrated leaflet No. 124 gives particulars of paraffin-electric welding plants.

**An Australian Exhibition.**—A scheme is on foot for holding an Empire Trade Exhibition in Sydney next September.

**Bankruptcy Proceedings.**—A. Whiteley, electrical and mechanical engineer, Llandudno.—Last day for proofs for dividend April 28th. Trustee, Mr. L. Hugh-Jones, Official Receiver, Crypt Chambers, Chester.

**Liquidations.**—Premier Lighting and Engineering Co., Ltd.—A meeting will be held on May 14th, at 4, Charterhouse Square, E.C., to hear an account of the winding up from the joint liquidators, Messrs. J. P. W. Goodwin and E. H. Hawkins.

Metalate, Ltd.—A meeting will be held on May 20th at 9/10, Pancras Lane, E.C., to hear an account of the winding up from the liquidator, Mr. G. S. Clarke.

Pure Lubricating Oil Co., Ltd.—A meeting will be held on May 15th, at 125, High Holborn, W.C., to hear an account of the winding up from the liquidators.

**Book Notices.**— *The Universal Electrical Directory* (J. A. Berly's). 1915. London: H. Alabaster, Gatehouse and Co. Price, complete "B," 21s.; "A" (British and Colonial only), 12s.—The electrical trade has come to regard the Red Book of the electrical industry as one of the most essential parts of its office equipment. Though the work of checking and revision of names and addresses on so large a scale in all parts of the world has been exceptionally difficult owing to the war, the contents have been rendered as complete and accurate as could well be expected. The entries in directories, like everything else British, European and Colonial, must inevitably be affected by present international occurrences, seeing that many electrical men in many countries are still young and of military age, and that colossal death-rolls and changes of occupation will yet ensue before hostilities come to an end. These unfortunate circumstances, however, in no way lessen the need for this publication; indeed, it may be said that the Colonial and foreign trade aspects of the position render it more necessary than ever, for British electrical manufacturers and traders are particularly anxious to secure information respecting undertakings in other countries which, under the anti-German and anti-Austrian sentiment of the times, want to secure British machinery and apparatus. The book itself is so well known, now that it has reached its 34th year of publication, that it is needless to detail its contents. It is a directory pure and simple, of electrical and allied men, companies, and systems, and is divided up into suitable sections covering respectively British, Colonial and foreign countries, Continental countries, and the United States. The alphabetical sections in each case are followed by classified trade sections, and, as usual, there is the well-tried British geographical section which travellers and others so highly value. The information regarding systems of supply at home and abroad is another department in which the Red Book has thoroughly established its reputation for usefulness. For the convenience of those who require only the British and Colonial sections these are published separately as Vol. "A."

*British Standard Specification for Portland Cement.* A new edition of the British Standard Specification for Portland Cement (No. 12), one of the most widely adopted of the Reports issued by the Engineering Standards Committee, has just appeared. Increased fineness of grinding of cement has been legislated for, and the minimum tensile strength at seven days of both neat cement and cement and sand has been raised. The clauses dealing with the preparation of the briquettes have been amplified, the procedure being described in greater detail than has previously been done. In the case of both neat cement briquettes and cement and sand briquettes, ramming or hammering is expressly prohibited. The growth of tensile strength at 28 days, both for neat cement and for cement and sand, is now given in the form of a formula in place of the fixed percentages which have been specified hitherto. All the plates have been entirely re-drawn, and two new plates have been added to the specification, which can be obtained from the Committee at 28, Victoria Street, S.W., price 5s. net.

The *Telephone Review* of the New York Telephone Co. has brought out a "Triumph of Science Edition" to commemorate the completion of the Trans-Continental telephone line on January 25th; the issue is worthy of the great occasion, and contains a number of interesting illustrations and articles bearing upon the work which first enabled the human voice to be conveyed over a distance of 4,500 miles. We extend our congratulations to the company both on the achievement itself and on the memorial which it has published.

"*Journal* of the Institution of Mechanical Engineers." No. 4, April, 1915. London: The Institution.

"*Journal* of the Röntgen Society." No. 43, Vol. XI. April, 1915. London: Smith & Ebbs. Price 4s. net.

"*Transactions* of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXX, Part 7. March, 1915. Newcastle-on-Tyne: The Institution. Price 5s.

"Electrical Engineering." Vol. I. By T. C. Baillie. London: Cambridge University Press. Price 5s. net.

"Circular of the Bureau of Standards." No. XXXVII. Electric Wire and Cable Terminology. Washington: Government Printing Office.

"*Bulletin* de la Société Internationale des Electriciens." Vol. V, 3rd series. No. XL. March, 1915. Paris: Gauthier-Villars. Price 3 fr.

"The Post Office Electrical Engineers' Journal." Vol. VIII, Part I. April, 1915. London: H. Alabaster, Gatehouse & Co. Price 1s. net.

**Our Trade with Australia.**—In the course of an interview printed in a Sydney newspaper, Mr. G. T. Milne, British Trade Commissioner in Australia, after condemning rash generalisations respecting the conservatism of the British manufacturer, and showing that United Kingdom trade was in a stronger position than ever before, stated:—"The whole problem of how to get trade is changed from the days when orders to a very large extent filtered through the hands of the London merchant, and it was not necessary for the manufacturer to personally engage in the hunt for markets. Nowadays, the latter method must be practised, or the manufacturer will be left at the post. This is the point up to which the English makers must be brought—the systematic and persistent seeking of markets, and I hope to see English firms establish responsible representatives in Australia, so that the most satisfactory amount of trade may be done between this Dominion and the Old Country. Small firms could combine to be jointly represented here. It is in this matter of being thoroughly represented on the spot that the English manufacturer can hurry up with advantage, and, where it is found that the tariff makes it advisable, branch factories could be established in order to cope with the trade that has been secured by nursing the local market and studying its requirements."

**Trade Announcements.**—Messrs. Chiswell & Co. announce that their offices are at Imperial House, Kingsway, London, W.C., and all communications should be addressed there.

The Harper Electric Piano (1910) Co., Ltd., has changed its title to the Harper Piano Co., Ltd., as, while it will still continue the electrical side of its business, it will do a bigger business than formerly in ordinary pianos.

## LIGHTING and POWER NOTES.

**Australia.**—The Sydney (N.S.W.) city electrical engineer has submitted a report of the probable expenditure by the electric lighting department for three years ending December, 1917, beyond what has already been approved by the Sydney Municipal Council; this includes for the power house £200,000; new sub-station and showroom, £90,000; mains and alternating-current sub-stations, £300,000; new buildings for stores and testrooms, £25,000; making a total of £615,000.—*Tenders.*

**Bacup.**—Market Rates.—The T.C. has adopted a flat rate of 1½d. per light for electricity supplied to occupiers of shops and stalls in the market on market days, and a further charge of ½d. per light per hour on other nights.

**Belfast.**—Large Diesel-Electric Plant.—What is stated to be the largest Diesel engine so far constructed has recently been installed at the shipbuilding yard of Messrs. Harland and Wolff. The engine, which was built by Messrs. Sulzer, is employed for the generation of electrical energy for lighting and power purposes in the shops; it is of the single-acting two-cycle type, and comprises six cylinders, 29·5 in. bore × 39·4-in. stroke, and has been designed to develop 3,750 H.P. at a speed of 142 R.P.M.

**Burton-on-Trent.**—Rate Relief.—The T.C. is now recommended to appropriate £5,000, instead of £4,000, from the gas and electricity departments in aid of the rates for the ensuing year.

**Canada.**—The Ontario Hydro-Electric Commission is now supplying current in bulk to three townships, 102 municipalities, and over 800 rural industrial enterprises. It was anticipated that by March over 100,000 H.P. would be distributed. The Chairman of the Commission recently stated that, apart from the benefit of cheap power to industries, the Province of Ontario would soon have 1,000 miles of publicly-owned electric railroads, and those would pay from the day they started operations. Already, in some districts, electric power was being applied to farm work. Farmers were cutting their ensilage and filling their silos by electricity, and were commencing to use electrically-driven threshing machines. The farmhouses, barns and stables were also lit by electricity, and power was used for domestic purposes, such as washing and ironing.

The Ontario Hydro-Electric Commission proposes to place all municipal electric plants under the management of local commissions; a Bill to this end is now before the Ontario House. In Ottawa and Toronto, which cities both have municipal electric plants, the Commission will be composed of the Mayor *ex-officio*, one member appointed by the City Council, and one member by the Hydro-Electric Commission—a Board of three. At present the municipal plant is managed by the four members of the Board of Control and the Mayor.

**Carnarvon.**—Proposed Loan.—The T.C. has applied for a loan of £500 for contemplated main extensions. The National Electric Construction Co. has written, suggesting that if, as was anticipated, the L.G.B. refused to sanction loans for further extensions, the Council should agree to the works being transferred to it or to a subsidiary company, on terms to be arranged. It was decided on April 6th to reply that the suggested transfer was *ultra vires*.

**Continental Notes.**—Norway.—The Odda Electrical Co. was started in 1913, with a capital of £500, to develop a small water-power, and up to the present its working shows a total surplus of no less than £800, or 145 per cent. of the capital. Electrical energy has been supplied for technical uses at such low prices as £3 per H.P.-year. Among the consumers are several farmers, who are using the energy for agricultural purposes, and as soon as the proposed extension of the station is completed, this example will be followed by pretty well all the farmers in the neighbourhood.

The Municipality of Ovre Eker, near Drammen, has under erection a new electrical works, which will derive their power from a waterfall at Hangsund. The station will be completed in the course of the summer, and the energy is partly to be used for industrial purposes.

It is reported from Notodden that the building operations at Rjukan II have been making good progress, and it is expected that the electrical station and the nitrate factories will be completed sometime in the course of the autumn.

The nitrate works at Notodden are to be extended, and four large acid towers provided in addition to those already in use.

The large works for the manufacture of ammonia have been completed, and are now in full use. This product was previously imported, but now the company not only meets its own requirements, but also disposes of a good deal for export.

The new electrical works at Skien have been taken over by the municipal authorities; energy is derived from a waterfall, which is located in a distance of 5½ miles from the town. The cost of the new works amounted to £34,000, and there are now subscribers to a total amount of 1,200 H.P., of which 600 H.P. are to be employed for lighting purposes. The revenue from this is estimated at £7,000, and the total expenses at £6,300.

Spain.—A concession has been granted for the establishment of a plant to utilise the water-power of the River Molins, near Tobera (Province of Burgos), in the generation of electrical energy for lighting and power purposes in the district.

A further concession authorises the use of the waters of the Rio Mundo, in the Province of Albacete, for the production of electric power.—*B. of T. Journal.*

Holland.—A Special Commission, which was appointed some three years ago in order to investigate the question of the national supply and use of electric current, has recently completed its report. The consumption of electric current for lighting is expected within the next few years to amount for the whole country to 84,787,000 KW.-hours per annum.

The result of the investigation shows that the larger industry should not pay more than 0·4d. to 0·6d. per KW.-hour (and at this price some of the large stations are already able to supply current), whilst the smaller industries probably would use electric energy even at a price of 1·6d. to 2d. per KW.-hour. The annual consumption to be expected is calculated at 170,858,000 KW.-hours for the larger industries, and 12,151,000 KW.-hours for the smaller industries.

The amount of electrical energy likely to be wanted for agricultural purposes is estimated at 3,690,000 KW.-hours, but a considerably larger amount is calculated for the many pumping stations, locks, &c., peculiar to Holland. These installations require a considerable amount of power, which is at present supplied by windmills, steam engines, motors and several electric stations. The former represent an aggregate capacity of 6,700 KW.; the steam engines, &c., of 18,740 KW.; and the likely annual requirement of electric energy is calculated at 13,500,000 KW.-hours. This figure would be more than trebled should electric power also be used for the contemplated laying dry of the Zuyder-Zee, inasmuch as this is expected to demand an annual aggregate of energy of about 34,000,000 KW.-hours. At present there is electric traction on the Hague-Rotterdam Railway and on eight tramways, but there is a question of electrifying, perhaps, half-a-dozen other lines where steam traction is used at present.

**Crewe.**—The Electric Lighting Committee has deferred consideration of an application from the Crewe Tradesmen's Association for electricity meter rents to be dispensed with until after the war.

**Dartford.**—Owing to the increased cost of coal and to the fact that the new plant is not yet in working order, the Electricity Committee anticipates a deficiency of £1,072 in the working of the undertaking during the six months ending September 30th next.

**Dewsbury.**—Public Lighting.—The Electricity and Tramways Committee has approved of the electrical engineer's estimate, amounting to £3,460, for lighting the streets in Ravensthorpe by electricity.

**Dover.**—L.G.B. Inquiry.—An inquiry was held on April 14th into the Corporation's application for a loan of £6,000 for new plant at the electricity works. The electrical engineer states that if the loan is refused other steps can be taken at the works.

**Dunfermline.**—The contractors for the new reservoir at Glenderon, Messrs. P. & W. Anderson, Ltd., propose to lay down a complete electrical installation for the driving of all the plant required in the constructional work.

**Eton.**—On account of reduced lighting, the electricity company has allowed a reduction of £5 9s. from the lighting account of the U.D.C.

**East Grinstead.**—B. of T. Inquiry.—On April 7th an inquiry was held regarding the application of the U.D.C. for a prov. order for electric supply. It was stated that there was a demand for electricity, and that at the present time there were 29 private electric light plants in the town. A private company was registered 19 or 20 years ago for the purpose of providing electricity, and the gas and water company in 1892 obtained power to apply for an order, but nothing had been done in the matter. It was proposed to run the works in connection with the refuse destructor, and the estimated cost was about £10,000. A hurried canvass taken at the request of the B. of T. showed 103 applications in the compulsory area and 74 outside, with only seven refusals. The estimates showed a loss of £182 on the first year's working and £68 on the second, and a profit of £102 on the third. Only seven persons objected to the scheme, and they resided within 300 yards' radius of the proposed site, which had been approved by the L.G.B. for the destructor.

**Hale.**—Proposed E.L.—The Aldershot U.D.C. has empowered the chairman of the Lighting Committee, the electrical engineer and the clerk to discuss with the Farnham U.D.C. the question of electric light at Hale. The parish is within the area of supply for electricity of the Farnham Gas Co.; and writing to the Aldershot Council on the matter, the chairman of the Farnham U.D.C. says that it appears to his Lighting Committee that it should not be within the gas company's power to sterilise that part of the urban district in regard to the provision of electric supply, and that it may not be impossible to secure the desired supply by other means.

**Hendon.**—The specifications of work in connection with the installation of electric light, &c., prepared by Mr. H. S. Brackenley, have been adopted by the Guardians.

**Holme (Yorks.).**—Village Lighting.—An electricity scheme has been promoted locally. It was decided to work it with 800 £1 shares, and the villagers quickly applied for 1,110 shares, and there had to be a process of selection. The company has acquired an old mill with water power, by which it is proposed to generate the current. During the Easter holidays the young men of the village gave their services in making certain desired alterations to the premises. A dynamo is to be purchased. The contract for the wiring has already been let to Messrs. Graham & Co., of Huddersfield. Public and private lighting will be undertaken. For house lighting it is proposed to charge a minimum of 30s. per year for three lights, with an extra charge of 4s. per year for additional lamps.

**India.**—The electrification of the Bombay Mint will be taken in hand shortly, and Captain Willis, R.E., is returning to Bombay for the purpose.—*Indian Engineering.*

**Irish E.L. Schemes.**—A Tipperary journal mentions that electric lighting is steadily coming into more general use in the towns of that extensive county. Fethard was the first to try the system; Rosrea is now lighted by an electric plant established at the local bacon factory; Clogheen has replaced oil lamps by electricity for public lighting, and Cahir has taken steps to form a company to supply electricity; Enniscorthy, in County Wexford, has taken steps, through its Urban Council, to obtain a prov. order to carry out a scheme.

**Leigh.**—Proposed Loan.—Application for sanction to the borrowing of £2,813 for extension of plant at the electricity works is to be sought by the T.C.

**Lincoln.**—Rate Relief.—The Electricity and Tramways Committee has decided to recommend that out of the current year's profits the sum of £1,500 be applied in the relief of rates for the year ending March 31st, 1916, and that, if necessary, a further sum of £500 be available.

**London.**—St. Marylebone.—A statement as to the December quarter's working shows that the gross profit was £39,797, as against £45,143 in 1913, the decrease being due to reduction in income amounting to £6,378, while expenditure fell by £1,032. Some 4,614,801 units were sold, as against 5,391,954 in the same period of 1913. Taking the nine months to December, the gross profit was some £3,740 less than for the same period of 1913. As regards the estimates for the year 1915-16, special charges due to the war figure at £12,000, while capital charges are about £800 higher, and taking all into account a net credit balance of £2,626 is expected.

**Loughrea, Co. Galway.**—Mr. John Murphy, who has been for some years in charge of the electric lighting plant at Clonmel Asylum, has been appointed manager of the new electric lighting works at Loughrea.

**Middleton.**—Mill Supply.—The T.C. has made arrangements with the Manchester Corporation for a supply of electricity for Neva Mills, and the laying of the cable will cost Middleton about £3,000. The cable will be big enough to bring electricity to the mill and to supply the borough generally if necessary, and the town will thus have a sort of stand-by. The arrangement with the mill is for 20 years, but may be terminated at the option of the mill company at 7, 10 or 15 years.

**Newport (Mon.).**—Price Increase.—Owing to the increased cost of coal, materials, and labour, the Electricity Committee of the T.C. has decided to raise the price of current after June by 20 per cent.

**Oulton Broad.**—Restricted Lighting.—The Electricity Co., having been applied to for an abatement off the public lighting account for the quarter just closed, owing to restricted lighting, has offered 10 per cent. The U.D.C. has replied that it is of opinion that it is entitled to a much larger abatement, if not total exemption.

**Portstewart.**—E.L. Scheme.—A system of electric lighting was introduced last week and has proved a success. The current is produced at Millbank, where a power station has been fitted up.

**Queensbury.**—The U.D.C., after considering amendments to the Bill of the Yorkshire E.P. Co., has decided to support the Bill.

**Runcorn.**—The Mersey Power Co., Ltd., announces that in spite of the present abnormal price of coal, its charges for current are not being increased.

**Shanklin.**—Restricted Lighting.—The Isle of Wight E.L. Co., having offered a deduction of £37 10s. from the lighting account for the March quarter on account of restricted lighting, the U.D.C. has asked for a further reduction, as only 47 of the 222 lamps are in use.

**Shelf.**—The U.D.C. has decided to support the Yorkshire Electric Power Co.'s application for lighting powers.

**St. Annes-on-Sea.**—The electrical engineer reports that lately there has been a gratifying increase in the output of current, the demand for heating purposes being especially notable. The consumers number 1,622.

**Stafford.**—After having received reports from the gas and electrical engineers and considered the matter, a special Committee recommended to the T.C. on Tuesday that—(*a*) The control of the gas and electricity works continue under one Committee as at present; (*b*) that no change be made in the management of the gasworks; (*c*) that Mr. W. H. Robins be appointed engineer and manager of the electricity works, presenting his reports direct to the Committee; (*d*) that Mr. W. M. Valon be appointed secretary for the electricity works, and countersign all orders exceeding £10 in value.

A proposal was made for placing the two concerns under separate control but was defeated, and the Committee's recommendations carried.

**Swansea.**—The electrical engineer has forwarded to the L.G.B. a list of employés who could be spared from his department for work on the manufacture of munitions of war.

**Sheffield.**—The Establishment Committee has approved of the Electric Supply Committee appointing an assistant mains engineer. The Electric Supply Committee has received an application from the military authorities for a supply of current to the South Yorkshire Asylum, Wadsley, outside the area of supply; it is proposed to make application to the B. of T. for sanction to the supply being given.

**Torquay.**—Proposed Loan.—The L.G.B. has refused to sanction a loan of £1,800 for the purchase of property required for offices and stores in connection with the alterations at the generating station. The Electric Lighting Committee has asked the town clerk to make such financial and other arrangements as may be required to meet the case, and to communicate with the Board expressing the hope that the application would be considered at a future date.

**Tunbridge Wells.**—Arising out of the recent L.G.B. inquiry into the application of the T.C. to borrow £8,137 for electric lighting purposes, the Lighting Committee has resolved to instruct the engineer to report on the provision of steel headers to two boilers in place of the existing cast-iron headers, and on the running non-condensing of the plant, &c., during the proposed rebuilding of the existing cooling tower; also to instruct the clerk to complete the contract with Witting & Partners for dismantling the existing cooling tower and building the new tower. The Committee has adjourned consideration of the report on the extension of mains until after the extension order has been granted by the B. of T. Application is to be made to the Board for consent to the supply of energy to Rusthall and Southborough, outside the area of supply.

**Turton (Lancs.).**—A number of applications have been received for electricity at Edgworth, but the D.C. has deferred consideration of them until after the war in consequence of the dearness of materials and labour.

**Walsall.**—Loan Sanction.—The L.G.B. have sanctioned the borrowing of £16,700 for the purposes of the electricity undertaking, viz., £13,000 for mains, £500 for services, and £2,900 for transformers. In view of the representations made by the Board in favour of reducing capital expenditure, the Committee has decided that any further extensions which are not required by manufacturers for war purposes will, for the present, be only carried out on the applicant providing the cost of the service. The electrical engineer has been given instructions to negotiate for a site in the Bescot district for a sub-station.

**Warrington.**—The Electricity and Tramways Committee has decided that the rent charged to tradesmen for the hire of outside arc lamps be reduced by one-half owing to the reduced lighting regulations.

**Wigan.**—Proposed Loan.—Application is to be made to the L.G.B. for sanction to borrow £6,000, the estimated cost of two boilers for the electricity works.

**Willesden.**—In the course of his speech as to the year's working, Mr. G. H. Hiscocks, referring to the electricity department, said that the 12 months started well in advance of all previous years, and up to the outbreak of war the purchase of energy from the Power Co. showed an increase of 20 per cent. This state of affairs, however, could not continue in view of the large reduction in public lighting since that date, but much new business had been secured, and the probable result of the year's working will be that the purchase from the Power Co. will be about 5 per cent. higher than in the preceding 12 months, while a number of important developments are being put in hand by various firms which, it is hoped, will substantially and permanently increase the revenue of the department.

## TRAMWAY and RAILWAY NOTES.

**Aberdeen.**—The Corporation Tramways Committee has instructed the manager to report as to the cost of altering the stairs on the cars recently operated on the P.A.Y.E. system, to the ordinary arrangement.

**Bolton.**—Restricted Services.—In consequence of enlistments—25 men from the department enlisted during the week-end—the Tramways Committee has this week curtailed the car services on five routes, and further curtailments on other routes will be made as and when necessary.

**Canada.**—The equipment of the Montreal Tramways Co. at Hochelaga power station has been extended by a 2,000-kw., 1,800 r.p.m. turbo-alternator set, to be used for peak loads and as stand-by, and capable of withstanding 25 per cent. overload for 24 hours, and 50 per cent. overload for two hours. The turbine is by Belliss & Morcom, and its moderate speed is claimed as a special feature. The guaranteed steam consumption is 9·8 lb. per h.p.-hour, using steam at 200 lb., 570° F., and with 28 in. vacuum. The blading is of the impulse type, the disk stage comprising two rows of Curtis steel blades compounded for velocity and the drum stage, phosphor-bronze blading compounded for pressure. A Michell main thrust bearing is used with a ball thrust coming into action only if the main thrust fails. Main and emergency governors act through an oil relay system, and a multi-jet ejector condenser is used. The alternator is a standard Swedish G.E.C. machine with 35-kw., 575-kw. engine-driven exciter.

**Edinburgh.**—The Tramway Committee is experiencing difficulty in getting a self-propelled car for the purpose of experimenting, and at last week's meeting it was suggested that as an alternative, one of the present cars be converted.

A report by the Tramway Committee as to the cost to the city had Colinton tramways been purchased (as suggested by the Commissioners at the recent provisional order inquiry) shows that for the price which the Corporation was asked to pay (£9,000), it would receive nothing of any value to it. The Corporation would have been liable for a sum of probably £12,290. The Tramway Committee has unanimously approved of the action of the Sub-Committee in declining to accept the conditions laid down by the Commissioners.

**Manchester.**—The Tramways Committee has decided to recommend that steps be taken with a view to an application being made in Parliament in the Session of 1916 for an extension of time for the construction of the Northenden Road (Sale) tramways.

At the meeting of the Tramways Committee, on Tuesday, a statement was issued showing that the number of eligible men in the service of the tramways at August 1st, 1914, was 2,895, but since then no less than 56·31 per cent. have joined the Colours. This number includes 876 married and 753 single men, total 1,629. Two hundred trolley boys have joined the Army. The total liability of the Committee for dependents is £1,113 per week, and since the outbreak of the war £26,924 has been paid.

**Oldham.**—A report by the general manager that there was not a satisfactory weather-screen device for tramway drivers on the market, was criticised at a meeting of the T.C. on April 7th; it was stated that 70 per cent. of corporations and companies used screens of one sort or another, and that further inquires were being made.

**Rochdale.**—Year's Working.—The gross tramway receipts for the year ended March 31st (excluding Heywood's proportion) amounted to £78,771, or £226 more than in the preceding year. The undertaking is said to be the only one in Lancashire, save Preston, which reports increased takings last year.

**South Shields.**—Year's Working.—The tramway receipts for the year ended March 31st last totalled £39,627, compared with £38,260 in the previous year, an increase of £1,376. The miles run were 927,727, an increase of 29,712, and the passengers carried numbered 10,479,421, as compared with 10,005,164, an increase of 474,257.

**U.S.A.**—Electric Cabs.—Some trials are being made in New York with an electric taxicab in connection with a proposal to start a service of such vehicles at the principal railway termini. The vehicle is covering a distance of 70 miles per day on a single charge of the battery, plus an hour's boost at mid-day.

**Walsall.**—The tramway manager has been instructed to proceed with the relaying of a portion of the Walsall Wood tramway extension as soon as the work in connection with the new road from Ablewell Street to Birmingham Road has been completed.

Year's Working.—The net profit of the Corporation tramways for the past year amounted to £2,479, of which it is proposed to devote £2,000 to the relief of the rates. It was pointed out that the passenger receipts amounted to £34,310, and they had carried free 81,000 soldiers and 2,000 refugees. In connection with an application by the employés for increased wages, a proposed Corporation bonus of 2s. to 2s. 6d. per week is not regarded as satisfactory, and something in the nature of a deadlock has arisen.

## TELEGRAPH and TELEPHONE NOTES.

**Post Office Tube Flooded.**—A sudden inundation of the Post Office tube, which imperilled the lives of a gang of men working on its construction, occurred about midnight on April 8th. The tube, after leaving the Post Office at Mount Pleasant, runs westwards under the centre of Calthorpe Street at a depth of between 40 ft. and 60 ft. Ten men were working in the head shield, cutting their way through the earth, when the water began to ooze through upon them. At first they tried to keep it out with boarding, but the percolating water gradually gained in volume, and at length the men had to run for their lives. The last man had scarcely got to a place of safety when there was a tremendous rush of water. In a very short time the tube was full. Many days must elapse before work on the tube can be resumed. Shortly after the inundation there was a sudden subsidence of the roadway in Calthorpe Street, leaving a cavity 20 ft. deep.—*The Times.*

**Secret Wireless on Board Ship.**—Recently the Dutch wireless stations intercepted a message from Zeebrugge in code, which was found to refer to the movements of shipping, and suspicion was aroused that it was addressed to a large German ship called the *Main*, which was lying in the harbour at Flushing. On examination it was found that a secret wireless installation in full working order existed on the vessel, the aerial wires being coiled round the mast and rigging. The incident was regarded as a grave breach of Dutch neutrality, and orders were given to prevent the further use of the installation.

**The Telephone Service.**—Hitherto it has been the practice to employ only male operators for night duty in the London telephone service, but it has now been decided to call up women operators for this purpose, owing to the large number of men who have enlisted for war service. They will be called upon, for four nights a week, to take up their duties at 8 p.m. and finish at 8 a.m., in conformity with the official schedule of 48 hours a week. Three hours out of the 12 are to be given for rest.

The necessity for the innovation is apparent when it is considered that out of the male staff of 1,500 as many as 440 have gone on active service. All these are paid their full salaries, less Army allowances, and guaranteed their positions when they return.

Ten of the staff have been killed in the war, and in accordance with the arrangements made their dependents have received a year's salary.—*Daily News.*

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Aldershot.**—April 20th. U.D.C. One 400-kw. D.C. turbine set, complete with surface condenser and circulating pumps, &c. One water-tube boiler with chain-grate stoker. See "Official Notices" March 26th.

May 4th. Steam and other pipework. Water-softening plant. See "Official Notices" March 26th.

**Australia.**—Melbourne.—April 19th. 13,560 yards of lead-covered cable, and 13 tons of bare hard-drawn copper cable, for the City Council. See "Official Notices" March 26th.

April 21st. 1,027,900 arc lamp carbons, for the Melbourne City Council. See "Official Notices" April 9th.

June 2nd. Electric lighting material for cars (Contract 28,187). Tender box, Railway Offices, Melbourne. Particulars at Contractors' Room, Spencer Street.* Deposit ½ per cent. of amount of tender.

June 2nd. Bogie trucks, wheels and axles for 10 cars of the St. Kilda-Brighton electric street railway (No. 28,621) for the Victorian Railway Commissioners.*

June 15th. Four mechanically-fired boilers, for the City Council. Specifications (£1 1s.) from the City Electrical Engineer.

June 15th. City Council. One turbine-driven boiler-feed pump, two fuel economisers, circulating water pumps. City Electrical Engineer. Specifications for each item, 5s.

QUEENSLAND.—June 1st (instead of March 16th). P.M.G. Switchboard for Warwick. See "Official Notices" March 26th.

SYDNEY.—May 31st. Three electric battery locomotives for Public Abattoirs, Homebush, for the Department of Public Works. Specifications, &c., 5s., from the Accountant, Public Works Department.

The City Council will shortly invite tenders for 2,000 insulators, disconnecting switches and fuses, incandescent lamps, and nitro-incandescent lamps.

Specifications for the items marked * can be seen at the B. of T. Commercial Intelligence Branch in London.

**Basingstoke.**—April 19th. Corporation. Diesel engine generating set, motor-generator, balancer, underground cables. See "Official Notices" April 9th.

**Bradford.**—April 17th. (A) 100 tramcar trucks, (B) 200 motors, 200 controllers, 200 automatic circuit breakers, for the Tramway Department. Specifications (A and B) one guinea each, from Tramway Offices, 7, Hall Ings.

**Darlington.**—April 20th. Corporation. 25-ton overhead traveller and economiser. See "Official Notices" April 9th.

**Dundee.**—April 28th. Corporation. Centrifugal circulating pumps, and 750 ft. of 42-in. and 30-in. cast-iron pipes. See "Official Notices" April 9th.

**France.**—Electric traversers, D.C. electric railway motors, multiple unit control equipments, cables and wiring for traction, heating and lighting, for the Administration des Chemins de fer de l'Etat à Paris. Particulars can be obtained in the Bureaux du Service Electrique (3rd div.), 72, Rue de Rome, Paris, between 3 and 5 p.m. on Tuesdays and Fridays, up to April 30th.

**Glasgow.**—April 16th. Corporation. Cables, meters, carbons. See "Official Notices" April 9th.

**Hull.**—The Corporation Property Committee has decided that three electric lifts be obtained, for the City Treasurer's Department, the City Accountant's Department, and the Rates Department.

**Italy.**—NAPLES.—April 30th. Tenders are invited for the supply and erection of a transmission line, with metallic posts, from the hydroelectric generating station at Volturno (Campobasso) to the receiving station at Naples. The estimated cost of the work is 1,131,955 lire, and a guarantee of 30,000 lire is required of the successful tenderer. Profile drawings, models of posts, &c., with other particulars, may be obtained from the Consiglio-Generale dell'Azienda per l'Ente, Volturno, and tenders must be submitted by April 30th.

**Lincoln.**—Tramway uniforms, for the T.C. The Electricity Works, Brayford Side North.

**Manchester.**—April 20th. Steel girder tramway rails and fish-plates. Mr. J. M. McElroy, General Manager (£1 1s., returnable).

April 14th. Corporation. Three 1,250 K.V.A. static transformers. See "Official Notices" April 2nd.

**Mountain Ash.**—April 26th. U.D.C. Sub-station building, E.H.T. underground cables, L.T. overhead lines and public lighting, E.H.T. switchgear, L.T. switchgear and transformers, for Abercynon. See "Official Notices" to-day.

**Rhondda.**—April 17th. U.D.C. Installation, 83 wiring points, 88 lighting points, at the Council Offices, Pentre. See "Official Notices" April 2nd.

**Spain.**—The municipal authorities of Valverde de Leganes (Province of Badajoz) have just invited tenders for the concession for the electric lighting of the town during a period of five years.

**Wallingford.**—April 19th. Telephone installation, infirmary to workhouse, with electric bell, for the B. of G. Mr. G. F. Slade, Wallingford.

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## CLOSED.

**Basingstoke.**—The B.C. has accepted the tender of the Electrical Apparatus Co., Ltd., for the supply of three and five-amp. meters for a period of 12 months.

**Australia.**—The following tenders have been accepted:—

Sydney City Council.—
Vehicle-charging apparatus.—Australian General Electric Co., £1,711.
Centrifugal pumps (motor-driven) for power house.—Falkiner, Ltd., £165.
Travelling cranes for sub-stations Nos. 71 and 72.—Luke Muras, £284.
C.I. valves and mild steel chutes.—William Elder & Co., £110 15s.
Copper-clad steel cable.—Western Cable Co., £374.
Water Board.—
No. 1 pumping station, Ultimo.—Centrifugal pumps and electric motors for Third Avenue low-level pumping station.—Zollner, Ltd. (a), £1,060 (recommended); (b), £957; (c), £941; (d), £773; (e), £939.
Centrifugal pumps and electric motors for Elliott Street low-level pumping station, Balmain.—Zollner, Ltd., (a), £1,014 (recommended); (b), £951; (c), £941; (d), £773; (e) £934.
Commonwealth.—Postmaster-General's Department.—
Telegraph Office, Deniliquin, 330 accumulators; Pritchetts & Gold cells, schedule 377a, item 1.—£203, Wm. Adams & Co. (accepted), 175, Clarence Street.
Erection of telephone line between Boree Creek and Greenvale.—£232, M'Donald Bros.
Erection of telephone line between Myrtle Creek and Rappville.—£107, H. Lancaster.
Erection of telephone trunk line between Cootamundra and Junee.—£3,467, M'Donald Bros.
Queensland.—
7,500 fuses in fibre tube, schedule 293, item 6.—£281, Western Electric Co.
2,000 telephones.—James Paton & Co.

The Richmond Council received the following tenders for a refuse destructor and auxiliary plant:—

| | |
|---|---|
| Horsfall & Co. ... .. .. .. .. .. .. | £9,360 |
| Stirling Destructor .. .. .. .. .. .. | 9,230 |
| Heenan & Froude.. .. .. .. .. (accepted) | 10,217 |
| Meldrum .. .. .. .. .. .. .. .. | 10,360 |

The consideration of the tenders turned largely on the question whether a British or Australian engine should be required, and eventually it was resolved that the successful tenderer indicated above be asked to install a Kelly & Lewis engine and feed pumps of Australian manufacture instead of the English-made engine specified by them. As notice of motion for rescinding the resolution was subsequently given, the matter was at the date of our information (February 17th) likely to be re-opened.

**Belfast.**—Messrs. Venner Time Switches, Ltd., have again secured the contract for time switches for the ensuing 12 months. Messrs. Chamberlain & Hookham, Ltd., have received a contract for meters.

**Bolton.**—The Corporation has placed a contract for the 12 months' supply of motor starting switches with the Electrical Apparatus Co., Ltd.

The managers of St. Matthew's School have accepted the tender of Mr. J. Morris for installing electric lighting.

**Bradford.**—The following tenders have been accepted by the Committees interested:—

John Brown & Co., Ltd.—300 steel tires, £437.
H. Summersgill.—Iron castings.
Collinson Bros.—Wiring the East Ward Branch Library, £126.
Smith & Croft.—Cable extensions, at Technical College, £80.

**Canterbury.**—The T.C. has accepted the tender of Mr. S. Terry, of Canterbury, for an electric motor and fittings for the sludge-mixing apparatus at the irrigation works, at £58.

**Clacton-on-Sea.**—The U.D.C. has accepted the tender of Messrs. Fitch for an outlet for the Diesel engine cooler, at £13 4s.

**Croydon.**—Messrs. Siemens Bros. Dynamo Works, Ltd., have secured the contract for the annual supply of Wotan, Tantalum, and carbon-filament lamps to the Corporation tramways.

**Dartford.**—The U.D.C. has accepted the tender of Messrs. J. Waddell & Sons for 350 tons of Kirkby rough slack for the electricity works, at £1 1s. per ton, and 150 tons of South Leicester nuts, at £1 2s. per ton.

**Dewsbury.**—The Electricity and Tramways Committee has accepted the tender of the Mackintosh Cable Co., at £164, for a mile of cable.

**Glasgow.**—The Tramways Committee recommends acceptance of the following offers:—

Switchboard, Govan Depôt.—Ferguson, Pailin & Co.
Roller shutters, Langside Shelter.—A. L. Gibson & Co.
Adhesive tape.—L. Andrew & Co.
Trolley wire.—J. Halley Craig.

**Hove.**—The electrical engineer has reported upon the tenders received for the supply of a turbo-generator and a set of battery accumulators. He finds that the best suited for the Council's requirements are a turbine connected with two generators in tandem. For this type of machine five tenders were received. When instructions were given to obtain tenders, it was contemplated that delivery could be obtained so that the new plant could be working in time for the next winter's load, but the engineer's opinion is that, owing to the war, the plant could not possibly be got to work before the middle of next December. The engineer points out that the prices are higher by 20 per cent. than they were three months ago, but that, in his opinion, the advantage to be gained in economy in working, and the savings to be effected in coal costs, outweigh the disadvantages of the increased first cost of the plant, and that had it not been for the Government's request to defer expenditure at the present time, he would have unhesitatingly advised the acceptance of a tender.

The Lighting Committee, reporting upon the engineer's remarks, states that it has resolved to postpone the installation of the additional turbo-generator plant, and to inform the tenderers accordingly. Nine tenders were received for the battery of accumulators, and the engineer recommends the acceptance of the Tudor Accumulator Co.'s tender, at £701, in respect of which the company also offers to maintain the same for a period of 10 years at a charge of £47 per annum. In conjunction with this battery, the Committee reports that it will also be necessary to have the two sets of battery boosters referred to in the engineer's report of December last. The engineer suggests that separate prices for the dynamos and motors and switchgear should be obtained, which would bring the cost of each unit below £100, and would enable the battery to be ready for work in 12 weeks after the date of the order being given. The engineer strongly advises that the new battery should be got to work as soon as possible, as it would enable the Council to give a better distribution of electrical pressure and also effect a good economy in working. The Committee has therefore come to the conclusion that, notwithstanding the recommendations of the Government to curtail expenditure, the installation of the battery is of sufficient importance to warrant the expenditure, and has resolved to recommend to the Council to accept the tender of the Tudor Accumulator Co. and its offer to maintain the batteries. The Council is also recommended to authorise the Committee to obtain and install the two sets of boosters, &c.

**Hull.**—At a meeting of the Corporation Telephone Committee, it was decided that either of the two lowest tenders should be accepted for the supply of cables, viz. :—

W. T. Henley's Telegraph Works Co., Ltd.—£575.
Union Cable Co., Ltd.—£547.

**London.**—Bethnal Green.—The Electricity Committee has accepted the tender of Messrs. Mellowes & Co., Ltd., at £52, for patent roof glazing with wired glass at the new substations.

Hammersmith.—The Electricity Committee recommends the B.C. to accept the tender of the Electrical Apparatus Co., Ltd., for the supply of ordinary meters for a period of three years, on the understanding that the price of brass rod in March, 1916, is not above 9d. per lb. Should this price increase the company's price to the Council would be advanced 5 per cent. Also tenders for insulating box filling compound, Limmer Asphalte Paving Co., and for the purchase of scrap metal at the electricity works, Messrs. W. & H. Cooper.

**Manchester.**—Among the tenders accepted for general stores required in the Tramways Department for the ensuing 12 months are the following :—

Connolly Bros.—Cable (power and lighting), bell wire.
F. Smith & Co., Ltd.—Copper cable (wire and strip).
Till & Whitehead, Ltd.—Sheet copper and brass wire rod and strip.
F. Smith & Co., Ltd.—Steel wire for armature banding.
Richard Johnson & Nephew, Ltd.—Galvanised-steel cable, &c.
John Ashton & Sons, Ltd.—Leather belting, &c.
D. Moseley & Sons, Ltd.—Canvas and fire-hose.
British Thomson-Houston Co., Ltd.—Motor and controller parts (B.T.H. equipment), motor cases (B.T.H. equipment), brush holders and spare parts (B.T.H. equipment), half-watt incandescent lamps (tungsten drawn-wire filaments).
D. C. Bate.—Circuit-breaker handles (B.T.H. equipment), pressed asbestos division plates (B.W. equipment) (portion), fibre dust rings.
Dick, Kerr & Co., Ltd.—Motor and controller parts (D.K. equipment), motor cases (D.K. equipment), armature and field coils (D.K. equipment), controller fingers (D.K. equipment).
British Westinghouse Electric & Mfg. Co., Ltd.—Motor and controller parts (B.W. equipment), armature and field coils (B.W. equipment), spare parts for brush holders (B.W. equipment), traction lightning arresters.
S. Grafrix, jun., & Bros., Ltd.—Hinge pins, arc lamp globes, &c.
L. Andrew & Co.—Fullerboard and mica tubes, fibre, &c., insulation tape, Chatterton compound, &c.
Electro-Mechanical Brake Co., Ltd.—Resistances (grid type) and spare parts.
H. Wallwork & Co., Ltd.—Grids for resistances.
P. R. Jackson & Co., Ltd.—Assembled commutator segments (B.T.H., D.K. and B.W. equipments), armature and field coils (B.T.H. equipment).
Kay & Co.—Brush holders and spare parts (D.K. and B.W. equipments).
Electrical Supplies Co., Ltd.—Controller fingers (B.T.H. and B.W. equipments) (portion).
Dyer & Young.—Controller fingers (B.T.H. and B.W. equipments) (portion).
Equipment & Engineering Co., Ltd.—Trolley poles, trolley heads, &c.
Drake & Gorham, Ltd.—Incandescent lamps, traction type (drawn-wire filament).
General Electric Co., Ltd.—Incandescent lamps (carbon filaments and 200 volt drawn-wire filaments), switches, bells, lighting material, telephones, &c.
Stella Conduit Co.—Steel conduit tubing, &c.
G. Schultz & Co.—Mica segments for commutator bars, &c.
A. Bates & Co., Ltd.—Asbestos.
Pinchin, Johnson & Co.—Insulation varnish and insulating compound.
Morgan Crucible Co., Ltd.—Carbon brushes for traction motors, crucibles, fireclay material, &c., for tilting furnaces.
Alfred Wiseman, Ltd.—Overhead equipment insulating material.
Estler Bros.—Canopy trolley bases, &c.
Fleming, Bickby & Goodall, Ltd.—Trolley-wheel bushes and spindles.
M. Cummins.—Auto-sanding devices.
John Taylor.—Tubular sanding devices.
Hadfields, Ltd.—Steel tie-bars.
Ibbotson Bros. & Co., Ltd.—Steel fish-bolts and nuts.
W. J. Ritchie & Co., Ltd.—Ball-races for trolley standards.
West Bromwich Spring Co., Ltd.—Truck springs.
Cammell, Laird & Co., Ltd.—Car axles, car-wheel tires (portion).
J. Brown & Co., Ltd.—Car-wheel tires (portion).
F. W. Rowlands & Co.—Car-wheel centres, gear and pinion wheels (portion).
British Hele-Shaw Patent Clutch Co., Ltd.—Gear and pinion wheels (portion).
J. Marsden & Co., Ltd.—Ordinary grey iron castings, chilled iron brake-block castings (portion).
National Rail and Tramway Appliances Co., Ltd.—Chilled iron brake-block castings.
J. A. Panton & Co. (representing Interchangeable Brake Block Co., Ltd.).—Chilled iron brake-block castings.
Armstrong Oiler Co., Ltd.—Lubricant pads for axle boxes.
J. Carr & Sons, Ltd.—Trolley cord.
Chamberlain & Hookham, Ltd.—Tramcar type ampere-hour meters.
Thermit, Ltd.—Welding portions.

**Maidenhead.**—The T.C. has received the following tenders for fuel oil for the electricity works :—

| | | | | |
|---|---|---|---|---|
| British Petroleum Co., Ltd. .. .. .. | £4 | 13 | 0 | per ton. |
| Anglo-American Oil Co., Ltd. .. .. .. | 3 | 17 | 5 | ,, |
| Anglo-Mexican Petroleum Products Co. .. | 3 | 8 | 0 | ,, |

The electrical engineer has been instructed to make tests with the oil of the Anglo-Mexican Co., and if these are considered satisfactory, arrangements will be made with them for a supply. The last three contracts for fuel oil were placed at £2 3s., £2 7s., and £3 8s. per ton respectively.

**Meter Contracts.**—Messrs. Chamberlain & Hookham, Ltd., have received the contract from Holyhead for the supply of meters for 12 months. Their tenders for meters for 12 months to Walthamstow and Mansfield have also been accepted.

**Rotherham.**—The Electric Light and Tramways Committee has accepted the tender of the British Niclausse Co., for two water-tube boilers, at £8,400.

**Salford.**—The tender of the Pendleton Ironworks Co., Pendleton, for the erection of the steelwork in connection with the central car depôt extension (£1,480) has been accepted.

**Sheffield.**—The City Council is recommended to accept the tenders of the General Electric Co., at £84, for spares required for the electric light and power plant at the Ewden Valley Waterworks, and for cables, lamps and fittings. The tender of Messrs. A. Reyrolle & Co., Ltd., is also recommended for acceptance, at £236, for one three-phase E.H.T. oil switch and four sets of metering gear.

**Sunderland.**—The T.C. has accepted the following tenders on behalf of the Electricity and Lighting Committee :—

B.I. and Helsby Cables, Ltd.—Cable, bifurcating boxes.
Ferranti, Ltd.—E.H.T. switchgear cabinet; two E.H.T. switch panels.
L.-R., G.-P. and Telegraph Works Co.—Cable.
Sanders, Rehders & Co.—C.O. two recorders.
General Electric Co., Ltd.—Metal-filament lamps.
Brunner, Mond & Co.—Supply of alkali.
General Electric Co., Ltd.—D.C. switchboard.

**Tunbridge Wells.**—The Lighting Committee of the T.C. has accepted the contract of the British Thomson-Houston Co., Ltd., for a 300-KW. steam alternator and condensing plant, at £3,132 instead of at £3,181, authorised on May 18th last.

**Wimbledon.**—The following tenders have been accepted for annual supplies to the Electricity Department :—

Engine-room Stores.

Pryke & Palmer.—General stores (255 items).
S. Peace & Sons, Ltd.—Files (34 items), chisel and tool steel, and shafting (four items).
James Harvey.—Destructor tools (five items).

Cables and Conduits.

Western Electric Co., Ltd.—Cables.
C. Macintosh & Co., Ltd.—Cable.
B.I. & Helsby Cables, Ltd.—Flexible cables.

Joint Boxes and Jointing Material.

Dussek Bitumen Co.—Compounds (two items).
W. Lucy & Co., Ltd.—Service and other boxes.
Sykes & Sugden, Ltd.—House fuse-boxes.
Callender's Cable & Construction Co.—Frames and covers (three items).
British Electric Transformer Co., Ltd.—Transformers.
Ferranti, Ltd.—Meters.
A. Duckham & Co., Ltd.—Oils.

**Wolverhampton.**—The Electricity Committee recommends the City Council to accept the tender of Messrs. Mossay and Co., at £630, for a 2½-ton Orwell electric vehicle and equipment.

## FORTHCOMING EVENTS.

**Institution of Mechanical Engineers.**—Friday, April 16th. At 8 p.m. At Storey's Gate, S.W. Ordinary General Meeting.
Friday, April 23rd. At 8 p.m. At Storey's Gate, S.W. General Meeting.

**Institution of Electrical Engineers (Newcastle Local Section).**—Monday, April 19th. At 7.30 p.m. At the Mining Institute. Lecture on "Illumination," by Mr. V. H. Mackinney.

**Institution of Post Office Electrical Engineers.**—Monday, April 19th. At 5 p.m. At Institution of Electrical Engineers, Victoria Embankment, W.C. Annual General Meeting.

**Electrical Trades Benevolent Institution.**—Monday, April 19th. At 6.30 p.m. At the Institution of Electrical Engineers, Victoria Embankment, W.C. Annual general meeting.

**Rontgen Society.**—Tuesday, April 20th. At 8.15 p.m. At Institution of Electrical Engineers, Victoria Embankment, W.C. Papers on "Late Radium and X-Ray Burns," by Dr. N. S. Finzi, and "A New Alpha Ray Effect, by Mr. F. H. Glew.

**Wireless Society of London.**—Tuesday, April 20th. At 8 p.m. At Institution of Electrical Engineers, Victoria Embankment, W.C. Lecture on "Methods of Measurement of the Strength of Wireless Signals," by Dr. E. W. Marchant.

**Association of Mining Electrical Engineers (West of Scotland Branch).**—Wednesday, April 21st. At 6.30 p.m. At Royal Technical College, Glasgow. Paper on "Bearings of Electrical Machinery," by Mr. A. Baxter. Discussion on paper on "Some Experiences in the Handling of Electricity," by Mr. M. A. Smellie.

**Chemical Society.**—Thursday, April 22nd. At 8.30 p.m. At Burlington House, Piccadilly, W. Paper on "Electromotive Force in Alcohol. Part VI. Absolute Potentials by the Capillary Electrometer," by Mr. E. Newbery.

**Junior Institution of Engineers.**—Friday, April 23rd. At 8 p.m. At 39, Victoria Street, S.W. Paper on "The Developments of the Navy," by Mr. E. W. Hobbs.

**Physical Society of London.**—Friday, April 23rd. At 5 p.m. At the Imperial College of Science, South Kensington. Paper on "The Self-Induction of Solenoids of Appreciable Winding Depth," by Mr. S. Butterworth.

**National Association of Colliery Managers and Association of Mining Electrical Engineers.**—Saturday, April 24th. At University College, Nottingham. Joint meeting. Paper on "Protective Devices against Lightning and Surges," by Messrs. E. Kilburn Scott and L. F. Fogarty.

## NOTES.

**Smoke Nuisance.**—At the Manchester Police Court on April 7th, Messrs. Connolly Bros., Ltd., electrical cable manufacturers, Blackley, were summoned for permitting black smoke to issue from one of their chimneys for 6½ minutes on February 27th. The offence was admitted, but in extenuation of the offence Mr. Connolly (one of the directors) pointed out that the firm were completely in the hands of the collieries with regard to coal supplies, and it was utterly impossible at present to secure the right kind of coal for the boilers. They were also handicapped by the scarcity of firemen, and could not get good men even at high wages. He also pointed out that the firm had spent over £600 during the last few months in installing electrical apparatus to combat the black smoke nuisance, and were even now engaged in fitting up additional electric driving plant to take the place of steam. He protested against the action of the Corporation in summoning them at a time when every firm was doing its utmost to keep up Government supplies for all kinds of material. The Stipendiary said the firm were old offenders, and must pay 30s. on this occasion. They had been frequently let off on promising to make alterations which would effectually deal with the black smoke nuisance, but at present that happy state of affairs seemed a long way off.

**An Electrical Bridge Over the Blue Nile.**—In the course of an interesting article in the *Engineer* for March 19th on the development of the Soudan, reference is made to the new rolling lift bridge across the Blue Nile at Khartoum, which provides direct railway communication with Khartoum, and has made possible the extension southward of the Soudan Government Railway system. This bridge, which has a length between abutments of 1,834 ft., ranks as the longest and most important bridge in Tropical Africa. In addition to two approach spans, there are seven more spans, each of 218 ft. 6 in., and a rolling-lift span giving a clear opening of 100 ft. The rolling span is electrically-operated and fully locked and signalled. The lighting of the bridge is effected by 36 70-volt Osram drawn-wire lamps, run two in series off the three-phase mains. Current is taken from the Khartoum town supply, and is delivered at the signal cabin at 3,000 volts three-phase, where it is transformed down to 140 volts. Electricity was used as far as possible for all power and lighting during the construction.

**Russian Copper Production in 1914.**—The production of metallic copper in Russia in 1914 amounted to 1,949,720 poods, against 2,095,288 poods in 1913. The difference, 145,568 poods is about 7 per cent. against 1914. The following table shows the production per district, the largest diminution being shown in the Caucasus, due, no doubt, to the military operations there:—

| | 1913. | | 1914. | |
|---|---|---|---|---|
| Ural ... ... ... ... | 1,055,122 | poods | 1,025,C55 | poods |
| Caucasus ... ... ... | 610,661 | ,, | 495,388 | ,, |
| Siberia... ... ... ... | 345,273 | ,, | 342,879 | ,, |
| Chemical works and refineries | 84,232 | ,, | 86,398 | ,, |
| | 2,095,288 | ,, | 1,949,720 | ,, |

**Power from Sawdust.**—Some time ago we mentioned an installation in Sweden of considerable size, in which electrical energy was generated from sawdust; by the courtesy of Mr. F. von Echermany, general manager of the Ljusne-Woxna Co., Ltd., of Ljusne, where the plant is installed, our Norwegian correspondent has been enabled to provide us with the following additional particulars.

The plant is designed for a maximum output of 4,200 H.P., but the first instalment provides for only 2,200 H.P. The fuel consists of a mixture of 80-90 per cent. sawdust and 20-10 per cent. chips, which, as taken from the mill, contains about 50 per cent. water; the mixture will be charged into gas-producers, and provision is made for the recovery of the tar, wood naphtha and acetic acid from the gas. As the result of tests of long duration, it has been found that the consumption of fuel is 1·8 kg. per H.P.-hour; the fuel costs 1s. per ton at the mill, and contains 50 per cent. water.

It is estimated that the cost of production with a plant of 2,200 H.P., including capital charges, and depreciation at the rate of 10 per cent. per annum, will be 0·42 öre per KW.-hour (0·055d.). Water-power in Sweden cannot be obtained for less than 1 öre per KW.-hour, and this only in a very few cases, the average cost of electrical energy generated from water-power being 2 öre per KW.-hour (0·26d.). It is expected that with wood-waste plant of 4,200 H.P. the cost per unit will be reduced to less than 0·046d.

The installation is being built by the Gasmotoren-Fabrik Deutz, of Cöln-Deutz, which, by means of a special experimental plant erected at Cöln, has solved the technical difficulties met with in the utilisation of wood-waste. The order for the plant was placed in December last, and the first of the two large gas engines was tested at Cöln in February; the whole plant is due for delivery, and it is expected that it will be running in July.

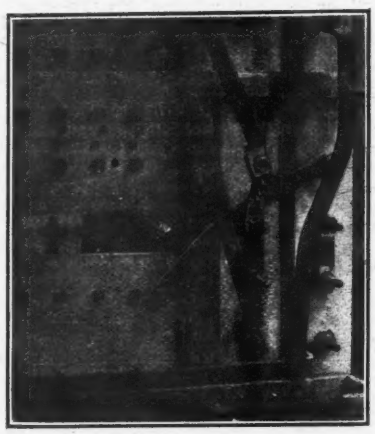
It is calculated that the amount of power available from wood-waste in Sweden, after providing for the driving of the saw-mills, is from 70,000 to 100,000 H.P., varying with the output of sawn timber. The Ljusne-Woxna Co. owns waterfalls near the works of 40,000 H.P., but has found it more economical to make use of the sawdust in the first place than to develop the water-power.

**Inquiries.**—Makers of cases for pocket electric lamps are inquired for by a Continental firm.

**Appointments Vacant.**—Junior assistant electrical engineers, over 19 (15s.), for Newcastle-on-Tyne Electric Supply Co.; draughtsman and general technical assistant (£120), for Newport Electricity and Tramways Department; switchboard attendant (30s.) for Torquay Electricity Department. Particulars are given in our advertisement pages.

**A Too-enterprising Rat.**—The accompanying illustration, for which we are indebted to Mr. C. A. Baker, electrical engineer to the London County Council, shows how an unfortunate rat met with an untimely end.

The view shows the back of a sub-distribution board which controls a portion of the lighting of the Rotherhithe Tunnel. At a recent periodical test it was found that the I.R. both to earth and between poles of one of the paper-insulated cables feeding this sub-board had fallen from 100 megohms, which was the usual



resistance obtaining, to between ·5 and 1·0 megohm. There was no apparent cause for the fall, but after examination it was traced to the back of the sub-board, which was then disconnected and taken out of the cast-iron case in which it was mounted; the illustration shows that the rat when climbing up one of the bare copper strip connections got its back in contact with the opposite pole, between which there is a difference of pressure of 100 volts A.C., and was electrocuted.

**Municipal Stores: The Need for Organised Buying.**—The Southport Corporation recently formed a special Stores Committee to organise and control the purchasing of stores common to the various departments. The Committee is composed of the chairmen of various other committees—including the Electricity and Tramways Committees—and it is expected that a great saving will be effected by combined buying. A list showing the varying prices paid for similar articles purchased by different committees gives the following interesting comparisons (among others):—For hacksaw blades, the electricity department pays 34s. 9d. per gross for 12 in. × ⅝ in. blades, and the tramway department pays 30s. per gross; the prices for block tin range from 1s. to 2s. 6d. per lb.; the Highways Committee pays 27s. 6d. and the electricity department 37s. 4d. per cwt. for white lead; for putty the same committees pay 7s. and 9s. 4d. respectively; boiled linseed oil costs 2s. 2d. per gallon to the Highways Committee, and 2s. 6d. per gallon to the Tramways; petrol prices range from 1s. 2d. (less rebate) paid by the Tramways Committee to 1s. 8d. paid by the Highways Committee; scrubbing brushes cost 14s. per dozen to one Committee, and range down to 7s. per dozen, the Electricity Committee paying 8s.; for soft soap, the prices range from 35s. per cwt. in the case of the Watch Committee to 14s., the Tramways Committee paying 15s. 9d., and the Electricity Committee 14s. 2d. per cwt. Schedules of goods common to the various departments are to be issued to contractors, and tenders invited for complete supplies.

**The Batti-Wallahs.**—The *Batti-Wallahs' Journal* for January-March contains portraits of the executive, chief of whom is the new president, Mr. Haydn T. Harrison, and reports of concerts, the annual dinner, and the annual general meeting. The report of the hon. secretary, Mr. F. Pooley, showed that the membership numbered 261.

On March 31st an informal evening was held under the chairmanship of Mr. Wm. Wyld, and was exceptionally well attended; an excellent entertainment was provided.

**Patents and Alien Enemies.**—Licences have been granted to Messrs. Pintsch's Patent Lighting Co., Ltd., in respect of patents Nos. 7,049/07 granted to Imray, and 14,950/10, 26,192/10, 19,369/11, 19,370/11, 3,561/13, 8,585/13, and 8,586/13 granted to Julius Pintsch Akt.-Ges.

**The I.E.E. Benevolent Fund.**—With reference to the appeal on behalf of this Fund, which was published in our last issue, Mr. P. F. Rowell, Hon. Sec. of the Fund, asks us to state that the annual contribution of even the smallest amounts would be greatly appreciated by the Committee of Management.

**Russian Architects and Electricity.**—At a meeting of the Society of Architects held on March 15th, says a Petrograd paper, M. N. Ph. Savelieff delivered an address on the proceedings of the recent Congress of the Technical Society, which treated of the economic situation of Russia. Deploring, like other Russian authorities, the predominance of Germany in the Russian industrial and mercantile field, he states that French and English products have not much vogue in Russia; and the only branches of the electrical industry that may be said to be in a satisfactory condition in the country include the production of cables and wire, and some electrical machines. Hitherto such have been imported only in small quantities. But the position is a bad one for fittings, such as the accessories that are required for the installation of telephone and telegraph wires and electric light. An examination on the premises of the Technical Society of samples of fittings of German production showed that these do not give full satisfaction in respect of quality. Their extensive use in Russia is explained by the low prices charged for them. A special Committee of the Society has prepared an album of the most practical electrical fittings. Most of these are of English production. It is much to be desired, he continues, that the makers of fittings now becoming established in Russia should follow closely the models recommended by the Committee referred to.

A great problem for Russian electricity at the moment is fuel. In most Russian central electric stations coal-fuelled steam engines are in use. Till recently all the Northern area of Russia used English coal. Now recourse has to be had to Donetz (South Russian) coal, some of the varieties of which resemble the English mineral. But putting aside the transport difficulties, there is the fact that the Donetz coalmasters are not equipped for supplying coal to the Northern area; nor are they disposed to accommodate themselves to this new demand from a market that may revert to the English when the war is over. Some of the audience recommended the use of peat, which is so abundant in Russia. But it appears that at the moment Russia is badly equipped for the preparation of peat.

**Professional Charges of Civil Engineers.**—The Council of the Institution of Civil Engineers has issued a statement to the members with regard to professional charges, with a view to uniformity in the basis upon which such fees are fixed. Engineers with larger experience command fees on a higher scale than younger and less experienced engineers, but the customary remuneration for ordinary professional engineering services, as distinct from remuneration by salary, for the design and superintendence of the construction of works in the United Kingdom is a commission of 5 per cent. upon their cost, which commission, however, is liable to be varied in accordance with the nature and magnitude of works and the character of the services rendered.

The preparation of bills of quantities, payments to resident engineers and inspectors, and also personal travelling expenses, are matters for arrangement depending upon the nature of the work and the circumstances under which it is carried out. Where the works are designed in sufficient detail to enable a contract for their execution to be made or to enable the Local Government Board to hold an inquiry into the propriety of allowing an authority to borrow money for the purposes of the works, but where the carrying out of such works is deferred indefinitely or abandoned, the fee for services up to this stage is one-half of the ordinary commission.

The Council is advised that plans and specifications prepared by an engineer belong, as chattels, to the client, after payment of the agreed fees, but the *copyright* in all original matter contained in such plans and specifications remains vested in the engineer. Neither the client nor any other person is entitled to multiply copies of plans and specifications so far as the original matter therein contained is concerned; and, further, if such original matter has "an artistic character or design," the plans can only be used for the purpose of the particular structure for which they were prepared by the engineer, or for such other purpose as he may authorise.

**The Concentric Wiring Question in the U.S.A.**—At New York, on March 23rd, was held the first meeting of a Committee elected by the manufacturers of electrical supplies and materials entering into electrical construction, under the following resolution:—

"Resolved, that a representative Committee of business and technical experts be appointed to investigate the all-insulated system of building wiring as used at present in this country, and coincidently investigate grounded return systems together with concentric wiring.

"First—To determine the relative efficiencies of the two systems (*a*) as to safety of persons, (*b*) as to protection against fire, (*c*) as to the possible provision of methods of wiring at low cost, combined with ease of installation and sufficiently attractive appearance to obtain popular approval.

"Second—To present to the entire industry the results of its investigations in the form of concrete recommendations, including standard systems, standard devices and standard appliances."

In view of the widespread effect of so radical a change in American wiring systems as would result from the complete adoption of grounded returns, the Committee decided to begin its investigations at once by thoroughly sifting the theoretical advantages of that system, and in so far as possible obtaining authentic data of the results obtained in England and Continental Europe, where grounded returns have been used more or less.

Those interested in this subject are invited to address communications to the Committee, care of Mr. Le Roy Clark, chairman, 114, Liberty Street, New York.—*Electrical World.*

**Molybdenum from Australia.**—The *Times* correspondent at Sydney cables that works for treating molybdenite ores have been established in Sydney, and it is expected that over 100 tons will be dispatched to England before the end of June from New South Wales and Queensland.

**Electromagnets in War Surgery.**—It seems likely (writes a correspondent) that when the story of war surgery comes to be written, the electromagnet will be found to have played no inconsiderable *rôle*. Hitherto in civil practice magnets have been used for extracting foreign bodies only from the eyeball, but the present war, at least so far as French surgery is concerned, has revealed their wider uses. Already two communications have been made on this subject to the Académie des Sciences of Paris, in both cases by French medical men actually engaged in the field, and the results appear to have been strikingly successful. Not all the projectiles employed in the war, of course, are of a magnetisable nature, and the French copper-sheathed bullets and the French and German lead shrapnel bullets have to be dismissed from the reckoning. It is otherwise, however, with splinters of cast shell, and also with the German bullets which are coated with an envelope of ferro-nickel. One of the French doctors, M. Rollet, states that he employs a giant electromagnet capable of supporting a weight of at least 1,150 kilograms (more than 22 cwt.), and taking 23 amperes at 110 volts. It attracts immediately the German bullet, weighing 10 grammes, at a distance of 11 centimetres, and splinters of shell at a still greater distance. This electromagnet is placed over the part where the bullet, as demonstrated by X-rays, is known to be lodged, and it causes a movement of the projectile. This worker states that, owing to the resistance of the tissues, it is not very useful to employ a small hand magnet, but that these very powerful electromagnets often succeed in bringing the bullet or other projectile nearer to the surface or into a more favourable position, and then an extraction with only a small incision becomes possible.

In a later communication to the Académie, Prof. J. Bergonié, of Bordeaux, states that he has also used an electromagnet with success in many cases. The instrument he employs weighs 40 kilograms (88 lb.), and has a magnetic core of special steel 60 mm. in diameter. The magnetising coil takes 3·5 amperes at 110 volts. This has been employed successfully where ordinary surgical procedure was dangerous. The purely surgical details would scarcely interest the readers of an electrical journal. Suffice it to say, that the electromagnet is kept over the part for 15 minutes or so every day, until after a number of such daily applications, in one case as many as 24, the projectile is brought so near the skin as to cause a cone-shaped raising of the surface at each application of the magnet. When this has happened, extraction by means of the knife is an easy matter. An important point while using the electromagnet is to keep opening and closing the magnetising circuit during the whole of the sitting, and the influence on the foreign body, granted, of course, that it has a magnetisable nature, becomes noticeable on X-ray examination, and ultimately by the sensations of the patient and the raising of the skin.

**A Canadian Electric Bakery.**—A prominent bakery in Toronto recently installed a Hughes electric oven, which is proving more economical than the furnace type oven which it replaced. Thus, the electric oven with a capacity of 180 1·5-lb. loaves, turned out 15 batches or 2,700 loaves in ten hours, while the brick oven with a capacity of 450 1·5-lb. loaves, turned out five batches or 2,250 loaves, or 450 less than the electric oven. The electric oven occupies 32 sq. ft. of floor space, as against 256 sq. ft. for the brick oven.

The cost of electricity, says the *Electrical Review and Western Electrician*, when used in the "off peak" period at Toronto, which is at night, is ·5 cent per KW.-hour. The maximum energy consumption of the electric oven was 26 KW.-hours, and would cost 13 cents per hour used continuously, or $1·3 for 10 hours' use, during which time 2,700 loaves were baked. *Pro rata*, this is equivalent to 48 cents fuel cost per 1,000 loaves, and this figure shows a saving in fuel over the brick oven of 41 cents per 1,000 loaves. The labour cost with the electric oven was less, the saving per 1,000 loaves being estimated at 22 cents.

We gather that the bread baked electrically has a better colour and will last longer as it is not dried out as in a brick oven; moreover, the cooking conditions are greatly improved and cleaner. The electric oven is ready to bake in 35 minutes after being switched on; by its use a considerable saving in first cost of a new bakery is ensured.

**Foreign Trade.** — THE MARCH FIGURES. — The following are the electrical and machinery figures given in the official returns for March:—

| | *Month of March.* | *Inc. or dec.* | *Three months, 1915.* | *Inc. or dec.* |
|---|---|---|---|---|
| IMPORTS. | £ | £ | £ | £ |
| Electrical goods and apparatus, excluding machinery and uninsulated wire | 67,626 | — 80,392 | 193,569 | — 236,160 |
| Machinery ... | 582,088 | — 142,859 | 1,774,025 | — 194,190 |
| EXPORTS. | | | | |
| Electrical goods and apparatus, excluding machinery and uninsulated wire | 276,970 | + 25,400 | 720,733 | — 42,776 |
| Machinery ... | 1,590,431 | —1,978,168 | 4,539,784 | —5,450,164 |

**A Lesson to Photographers.**—At the Newcastle-on-Tyne Police Court on Tuesday, Lancelot Edmund Hendry, chargeman electrician, was charged under the Defence of the Realm Act with having taken a photograph in the electric shop at the Armstrong Elswick Works, without permission. Evidence for the prosecution was to the effect that on Saturday last accused was observed climbing down some pipes which cross the turbine shop, and when questioned said he had taken a photograph. He was told that he might get six months if caught, and replied: "Well, perhaps," as he walked away. Shortly afterwards he was placed under arrest and the negatives were developed. Chief Superintendent Bestwick said prisoner had not received permission to take the photographs. He was a native of Stockton and served his time with the Stockton Corporation as an electrician, afterwards going to the Sunderland Corporation. He was married and resided in Sunderland, where witness had examined his house. He appeared to be an amateur photographer, and photographs of machinery in which he was interested were found. The evidence, as a whole, was of a negative character. Defendant admitted he had done a foolish act. Photography was his hobby, and he had tried to keep a record of the places he had worked in. Apart from that he had no interest in the matter. The chairman said the case was a most serious one at a time like the present. Defendant had given no proper explanation of his action, and therefore the least the Bench could do was to impose a fine of £20, or 51 days' imprisonment. They had taken into consideration the defendant's statement that he had no evil intention; but having regard to the evidence, the fine would have to be paid forthwith.

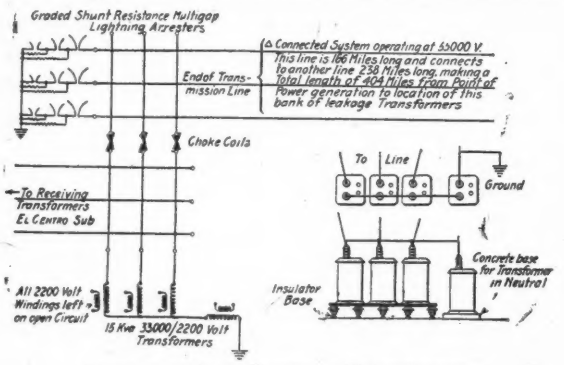
**Static Electricity on a long Transmission Line.**—Writing to the *Electrical World*, Mr. C. O. Poole, chief engineer of the Southern Sierra Power Co., says with regard to the use of inductive reactance connected on lines to ground for bleeding off the accumulation of static electricity:—

Several months ago, and before I knew anything of this practice, we had a very bad case of static on a 55,000-volt transmission line that we constructed in connection with the Coachella Valley Ice and Electric Co. in the Imperial Valley. This line was built on wooden poles, the conductor being of 3/0 7-strand aluminium. We used No. 351 Locke insulators, the wires being spaced on an equilateral triangle, 72-in. centres, and the length of the line being 166 miles.

We connected this 55,000-volt line at the terminus of a 238-mile transmission system from Inyo County—connection being made at San Bernardino sub-station, this making a total transmission system from our power house at Bishop, Cal., of 404 miles.

The Imperial Valley line is operated delta at 55,000 volts. Shortly after the system was put into operation trouble was experienced by two or three of the pole tops burning off and causing short-circuits on the system. I made a trip over the line at night in the Imperial Valley and found a great number of insulators leaking static badly, which resulted in charring the pole and cross-arms, and I realised that something must be done at once to relieve the condition. I conceived the idea of bleeding the static off to ground, and recommended that the Holten Power Co., at El Centro, the end of the line, install four 15-KW. transformers we had in stock and connect them directly between the line and ground.

These 15-KW. transformers were wound on the primary side for 33,000 volts and on the secondary side for 2,200 volts. Three of these transformers were connected in star on insulated platforms, and the fourth transformer was connected between the star of the


Graded Shunt Resistance Multigap Lightning Arresters
To Connected System operating at 55000 V.
This line is 166 Miles long and connects to another line 238 Miles long, making a Total length of 404 Miles from Point of Power generation to location of this bank of leakage Transformers
End of Transmission Line
Choke Coils
To Receiving Transformers El Centro Sub
All 2200 Volt Windings left on open Circuit
15 Kw 33000/2200 Volt Transformers
To Line
Ground
Concrete base for Transformer in Neutral
Insulator Base

ARRANGEMENT OF BLEEDING TRANSFORMERS.

three transformers and ground on the primary side, the secondary 2,200-volt windings being left open. The object of using the fourth transformer was to protect the 33,000-volt circuit from over-voltage in the event of ground appearing on the 55,000-volt circuit.

The effect of this installation was immediately to overcome all the difficulty with the leaking static, and the line now is as quiet and free from static as could be desired. The sketch herewith shows the arrangement of these bleeding transformers as connected to the system.

**Edison to Make Benzol.**—It is announced in the *Elecl. Rev. and Western Electrician* that Thomas A. Edison has opened a factory in Johnstown, Pa., for the manufacture of benzol from coal gas, a process never before developed in the United States. Since the war began there has been a great shortage of this product.

**Institution and Lecture Notes.—Royal Society of Arts.**—In the list of arrangements for meetings during April and May the following appear:—

Wednesday, April 14th, at 8 p.m. T. Thorne Baker, "The Industrial Uses of Radium."
Wednesday, April 28th, 8 p.m. A. S. E. Ackermann, "The Utilisation of Solar Energy."
Wednesday, May 5th, 8 p.m. Dr. A. Vernon Harcourt, F.R.S., on "The Measurement of the Efficiency of Domestic Fires, and on a Simple and Smokeless Grate."
Wednesday, May 12th, 8 p.m. Charles R. Darling, "Recent Progress in Pyrometry."
Thursday, May 13th, 4.30 p.m. (Indian Section.) Sir Charles H. Armstrong, "Indian Trade and War."

The paper by Mr. A. S. E. Ackermann will supplement that given before the Society of Engineers in April, 1914, by dealing with the experiments of other workers in the field.

**Illuminating Engineering Society, U.S.A.**—The ninth annual Convention of this Society will be held at the New Willard Hotel, Washington, D.C., September 20th-23rd inclusive. Mr. E. S. Marlow, of the Potomac Electric Power Co., Washington, D.C., is chairman of the Convention Committee.

**Institution of Electrical Engineers.**—At the meeting of the MANCHESTER LOCAL SECTION, on Tuesday last, a paper was read by Mr. J. H. Rider on "The Power Supply of the Central Mining-Rand Mines Group." The same paper was read at Birmingham on Wednesday and in London last night.

At the annual business meeting of the SCOTTISH LOCAL SECTION held in Glasgow, on Tuesday last, the following office bearers were elected for the ensuing year:—Chairman, *Mr. David A. Starr; vice-chairman, *Mr. J. K. Stothert; chairman of Students' Section, Mr. Archibald Page; ordinary members of Committee, Messrs. J. S. Nicholson, E. T. Goslin, G. Stevenson, J. E. Sayers, A. S. Hampton, Prof. J. D. Cormack, *Messrs. F. H. Whysall, *W. W. Lackie, *Prof. Magnus Maclean, *A. Lindsay, *A. Wilson; hon. secretary and treasurer, Mr. Joseph Taylor; assistant hon. secretary, Mr. Wm. F. Mitchell. *New members of Committee. The annual report showed that the membership was 370, a reduction of 5 per cent. on the previous year, while the attendance at the ordinary meetings averaged 47, about the same as last year.

At the ordinary meeting which followed, Mr. W. M. Selvey read his paper on "Power Plant Testing."

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.*

**Central Station Officials.**—The Redditch T.C. has appointed, out of 106 applicants, MR. VALENTINE F. BUSH, of West Ham, as assistant engineer at the electricity works, at £170 per annum.

MR. H. C. ASHTON has been appointed assistant engineer at the Hammersmith electricity works, at a salary of £175 per annum.

Mr. J. Devoy, mains superintendent at the Tunbridge Wells electricity works, has resigned his appointment. The Committee has resolved to grant MR. J. E. POWNALL, chief assistant electrical engineer, a gratuity of £10 for extra work done since the commencement of the war.

MR. J. CHISNALL, foreman fitter at the Blackpool electricity works, on leaving to take up an appointment with Messrs. Vickers, at Barrow, was presented with a Gladstone bag, a wallet, and other gifts from the staff and workmen. Mr. W. W. Parkinson made the presentation.

MR. F. YOUNG, electrician on the Dover Corporation tramways staff, who has resigned, has been presented by his colleagues with a silver rose bowl.

MR. W. W. LACKIE, City electrical engineer, is nominated for the Presidency of the Institution of Engineers and Shipbuilders in Scotland.

MR. J. C. WILLIAMS, chief assistant and deputy engineer at the Rotherham Corporation tramways and electric light department, who is leaving to become electrical engineer and manager at Erith, has been presented by the staff and employés with a gold watch, and by the Executive Committee of the Rotherham Municipal Officers' Guild with a set of solid silver *entrée* dishes.

**Tramway Officials.**—MR. J. ELLISON has been appointed chief inspector to the Darwen Corporation Tramways. Through the war it has been decided not to fill the vacancy caused by the death of Mr. Moses Stokes, superintendent of the line. Mr. Ellison will officiate in the management as deputy to Mr. Hoskens.

MR. DUGDALE, the Oldham Tramways manager, who has been ill for some time, has now resumed his duties.

**General.**—The vacancy in the chairmanship of the Crewe Corporation Electric Lighting Committee, caused through the death of Mr. Councillor Chapman, has been filled by the appointment of ALD. J. H. KETTELL.

The Chairman of the Council of the Society of Arts, Col. Sir Thos. Holdich, on Monday afternoon presented the Society's Albert Medal to SENATOR GUGLIELMO MARCONI, G.C.V.O., LL.D., D.Sc., "for his services in the development and practical application of wireless telegraphy."

Bailies Smith and Hannay, along with Mr. Wm. Lackie, the chief electrical engineer, are to represent Glasgow T.C. at the twentieth annual convention of the Incorporated Municipal Electrical Association, to be held in London in June next.

Mr. W. E. Pott, late general manager of Messrs. Krupka and Jacoby, Ltd., and British Graetzin Light, Ltd., of Westminster, has been appointed manager of the Electric Novelty Department for Messrs. J. S. Hind & Co., of 6, Eldon Street, E.C., representing the Interstate Electric Novelty Co., of America.

**Obituary.**—Major S. Flood Page.—The death occurred on April 7th, at Inverness Court Hotel, London, at the age of 82 years, of Major Samuel Flood Page, whose connection with electrical undertakings in London on the commercial and financial side dates back over a lengthy period. From the records in our own pages, it appears that the gallant Major entered the electrical arena in the year 1882, when, in the capacity of manager of the Crystal Palace, he organised the Electrical Exhibition held there. Presumably his connection with that event gave him that commercial interest in electrical affairs which extended over so many years, for it was in the year of the Exhibition that he became general manager of Edison's Indian and Colonial Electrical Co. He left in September, 1882, for a tour abroad to prosecute the company's business in India, Ceylon, South Africa and the Australian Colonies. In some of these Colonies companies were started. In 1882 gas was 12s. 6d. to 15s. per 1,000 cb. ft. at the Cape of Good Hope, and very dear in India and the Colonies, and it was considered that if electricity could compete with gas at 3s. per 1,000 here it would do far better in the Colonies, &c. In this belief the Edison lighting schemes with which he was identified were launched. The Marquess of Tweeddale described Major Flood Page as a "gentleman of great energy," which he undoubtedly was in all his concerns whether we remember his later association in different capacities with the Edison & Swan United Electric Light Co., Ltd., with the London Electric Omnibus Co., Ltd., or with the London Chamber of Commerce. The London Electric Omnibus Co., Ltd., was formed in 1896, with a quarter of a million capital. What happened to that unfortunate concern is now more or less a matter of history—we fear forgotten, or even never known, by many men who are to-day interested in electrical vehicle matters. Briefly, it may be described as a concern born in advance of the times by over-sanguine men, and as one of those companies which make promises with reckless prodigality, but find themselves incapable of carrying those promises out to the stage of performance. In recent years, Major Flood Page had not appeared so prominently as formerly in electrical affairs, owing to his advancing years, but he had for a long time been on the board of three of the Marconi Wireless Companies, and was so at the date of his death. At different times in the course of his manifold activities he was described by others as sanguine, enthusiastic and full of energy, and by himself as a "practical business man."

Prof. W. G. Adams.—We regret to hear of the death, which occurred at Broadstone, Somerset, on 10th inst., of Mr William Grylls Adams, F.R.S., F.G.S., Emeritus Professor of Natural Philosophy and Astronomy at King's College, London. He retired from that office about nine years ago. The deceased gentleman, who had reached the ripe age of 79 years, was a past president of the Institution, he having delivered his presidential address before the Society of Telegraph Engineers and Electricians in January, 1884. In following years he was also the author of numerous papers on electrical, magnetic and other scientific matters. Prof. Adams had occupied the presidential chair of the Physical Society, and he attained considerable eminence as a mathematician and an astronomer.

Herr M. Hiller, a director of the Landsberg Kabelfabrik Gesellschaft, of Landsberg, Westphalia, is among the German officers killed in the war.

Mr. L. U. Vignoles.—We regret to learn of the death, which took place on April 6th in Argentina, at the early age of 34 years, of Leonhard U. la H. Vignoles (commonly known as "Toby"). No details are yet to hand, but he was extremely ill some eight years ago, and was believed to have a foreign body in one of his lungs. He then made a marvellous recovery, but was subsequently liable to chronic pneumonia, to which it is to be feared that his early death is due. He leaves a widow and two baby children. Mr. Vignoles served in the South African War, and at different stages in his career was with Messrs. Crompton, the British Westinghouse Co., and Messrs. J. G. White & Co.

M. Jean Annibal Lege.—We regret to learn from a correspondent (Mr. H. L. Joly, A.M.I.E.E.) of the death, at the age of 74, of M. Jean Annibal Légé, a French engineer. M. Légé was associated with the electrical industry in the early days in the shops of Breguet and of Mildé, in Paris. "Later, in 1868," says our correspondent, "he came over to London and started where Mr. W. Mackie's works were, in a yard on the east side of Farringdon Road. There he constructed the first tide-predicting machine for the late Lord Kelvin. There also, I believe, he was associated with the earlier types of arc lamps, the Pilsen—and Mr. H. F. Joel will, doubtless, regret to hear of his death. For many years he was the maker of electric signalling lamps, of 'universal dotters,' targets, &c., designed in collaboration with Admiral Sir Percy Scott; in fact, only recently he was working on some electrically-controlled apparatus for the Admiralty. His inventions range from horological mechanism, somewhat lightly mentioned by Lord Grimthorpe in his book, to a dragged torpedo which anticipated the Brennan, and to petrol motors; his name is attached to a goodly array of patents. I may add that in his earlier days—45 odd years ago—he was in contact with Karl Marx and the Internationalists, and that his works have proved a haven of refuge, a stepping-stone to many a man of ability, either Briton or foreigner, just landed in London. From some 18 years of personal contact, I can vouch that no works could be found where a greater harmony reigned between principal and worker."

Mr. David Smith.—We have to announce with much regret the death, on the 10th inst., at the age of 50, of Mr. David Smith, managing director of the United River Plate Telephone Co., Ltd., and also a director of the Constantinople Telephone Co., Ltd. Coming to London from Scotland some 20 years ago, Mr. Smith entered the service of the Electric Construction Co., and later the Electrical Power Storage Co. The late Sir Irving Courtenay, then chairman, impressed by his business capacity, selected him to fill the vacant secretaryship of the United River Plate Telephone Co. in November, 1914. He was subsequently appointed managing director. For some time past his health had caused some anxiety to his friends, though, until quite recently perhaps, none was prepared for a fatal termination. Highly esteemed by his colleagues, he was much respected by all who were brought into business relations with him, and those who were privileged to enjoy his friendship will mourn the loss of a helpful and cheerful companion, whose actions were invariably governed by high principles. Much sympathy will be felt for the widow and two young children.

## NEW COMPANIES REGISTERED.

**Elbron Metallising Co. (1915), Ltd.** (139,823).—This company was registered on March 30th, with a capital of £100 in £1 shares, to take over the business carried on by L. G. Lewis at 42, Berners Street, W., as the "Elbron Metallising Co.," and to carry on the business effecting the electrolytic deposit of metals on non-metallic substances, engineers, machinists, coppersmiths, metallurgists, etc. The subscribers (with one share each) are: A. C. Crowl, 15, Harringay Gardens, Green Lanes, N., clerk; S. F. Hewett, 33, Stavordale Road, Highbury, N., clerk. Private company. The number of directors is not to be less than two or more than five; the first are L. G. Lewis (permanent director and chairman) and M. Dodds. Registered office: 42, Berners Street, Oxford Street, W.

**Radio Electric Lamp Co., Ltd.,** (139,784).—This company was registered on March 26th, with a capital of £200 in £1 shares, to carry on the business of manufacturers of and dealers in electric lamps and all kinds of devices for lighting or heating by electricity, electricians, electrical contractors and engineers, etc. The subscribers (with one share each) are: C. M. Holmquist, 69, Leighton Road, West Ealing, W., electrical engineer; P. Adair, 163, Denmark Hill, S.E., electrical engineer. Private company. The directors are to number not less than two or more than five. C. M. Holmquist signs documents as director. Registered office: 27, Kingly Street, Regent Street, W.

**Newcastle West and District Electric Light and Power** Co., Ltd. (4,227).—This company was registered in Dublin on March 30th, with a capital of £3,000 in £1 shares (2,000 pref.), to carry on the business of electricians, mechanical engineers, manufacturers and contractors, etc. The subscribers are:—W. Phelan, Newcastle West, merchant, 25 shares; W. A. Phelan, Galbally, Co. Limerick, merchant and farmer, 25 shares; M. Phelan, Walshestown, Co. Limerick, farmer, 1 share; J. Phelan, Newcastle West, Co. Limerick, manager, 1 share; Mrs. B. Phelan, Newcastle West, Co. Limerick, 25 shares; Mrs. M. Phelan, Newcastle West, Co. Limerick, 25 shares; J. Phelan, Newcastle West, Co. Limerick, shop keeper, 1 share. The first directors are W. Phelan, W. A. Phelan and Mrs. B. Phelan. Qualification, one share. Registered office: South Quay, Newcastle West, Co. Limerick.

**Fallolite, Ltd.** (139,852).—This company was registered on April 1st, with a capital of £5,000 in 4,850 pref. shares of £1 each and 3,000 ordinary shares of 1s. each, to carry on business as a lighting and heating company, to manufacture and deal in lamps and stoves and any kind of lighting or heating apparatus and plant, etc. The subscribers (with one share each) are: L. E. Tucker, 5, Noel Road, North Acton, W., clerk; L. P. Potter, Broad Street House, E.C., solicitor. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. Solicitor: C. R. Enever, Broad Street House, E.C.

**Salsbury Co., Ltd.** (139,910).—This company was registered on April 9th, with a capital of £100 in 1s. shares, to take over the business carried on at 11, Long Acre, W.C., as Salsbury Lamps, Ltd., and to carry on the business of manufacturers of and dealers in lamps, electricity, gas, oil and other illuminants, cycle and motors cars, aeroplanes, and hydroplanes, engineers, founders, etc. The subscribers (with one share each) are: W. D. Berry, Maxwell House, Arundel Street, Strand, W.C., clerk; Amy A. Dalton, Maxwell House, Arundel Street, Strand, W.C., clerk. Private company. The first directors (to number not less than two or more than seven) are to be appointed by the subscribers. Registered office: 11, Long Acre, W.C.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**Sevenoaks and District Electricity Co., Ltd.**—Particulars of £15,000 debentures, created November 25th, 1914, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

**G. H. Turner and Co., Ltd.**—Particulars of £500 2nd debentures, created March 17th, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £260. Property charged: The company's undertaking and property, present and future, including uncalled capital, subject to £350 1st debentures. No trustees.

**Derby Lamp Works, Ltd.**—Debenture, dated 24th March, 1915, to secure £6,000, charged on the company's undertaking and property, present and future, including uncalled and unpaid capital. Holders: F. W. Greaves, Derby, and J. Rae, 4, Bartholomew Lane, E.C.

**Flather and Co., Ltd.** (74,602).—Capital £3,000 in £1 shares. Return dated December 18th, 1914. 1,910 shares taken up; £1 per share called up on 410 shares; £410 paid; £1,500 considered as paid on the remainder. Mortgages and charges: £1,000.

**Coast Development Corporation, Ltd.**—Eight mortgages, dated March 24th, 1915 (supplemental and pursuant to mortgage dated June 24th, 1903, securing an amount not exceeding £20,000, of which £16,650 is now outstanding), charged on various properties in Felixstowe and Southwold. Holders: F. P. Matthews, Hearn Street, Curtain Road, E.C., and E. J. Bellord, 8, Waterloo Place, Pall Mall, S.W.

**Montreal Tramways and Power Co., Ltd.**—Particulars of £1,541,695 17s. 9d. ($7,500,000) gold notes created March 10th, and secured by trust deed dated April 1st, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £1,438,356 3s. 3d. ($7,000,000). Property charged: $6,000,000 5 per cent. mortgage debenture stock of Montreal Tramways and Power Co., Ltd., 16,000 shares of common stock of $100 each in Montreal Tramways Co., 59,000 shares of common stock of $100 each and $1,800,000 principal amount of the first mortgage 5 per cent. bonds of the Canadian Light and Power Co., and 1,950 shares capital stock of $100 each in the Montreal Public Service Corporation. Trustees: Bankers' Trust Co. (New York).

**London Electric Supply Corporation, Ltd.** (24,957).—Capital, £1,300,000 in 200,000 ord. shares of £3 each, 90,000 pref. shares of £5 each, and £250,000 unclassified shares. Return dated March 11th, 1915. 111,000 ord. and 89,840 pref. shares taken up; £3 per share called up on the ord. and £5 per share on the pref. shares; £782,360 paid, including £160 paid on 160 shares forfeited. Mortgages and charges, £487,355.

**Pernambuco Tramways and Power Co., Ltd.**—Issue on March 9th, 1915, of £25,000 debentures, part of a series of which particulars have already been filed.

**Carville Site and Power Co., Ltd.**—Issue on March 29th, 1915, of £10,000 debentures, part of a series of which particulars have already been filed.

**Telegraph Construction and Maintenance Co., Ltd.** (1,147c).—Capital, £448,200 in £12 shares. Return dated March 18th, 1915. All shares taken up; £448,200 paid. Mortgages and charges: Nil.

**Lamp Manufacturing Co., Ltd.** (76,151).—Capital £10,000 in £1 shares. Return dated February 4th, 1915. 5,400 shares taken up; £5,400 paid. Mortgages and charges: £2,500 debentures.

**H. F. Foster and Co., Ltd.**—Issue on March 31st, 1915, of £550 debentures, part of a series of which particulars have already been filed.

## CITY NOTES.

### Swiss Electrical Companies.

*The Société Franco-Suisse pour l'Industrie Electrique, of Geneva,* which is closely connected with the group of the Banque de Paris, recently announced that although the electrical undertakings in which the company is interested are developing satisfactorily, some of them had not paid any interest on the loans for 1914. This statement is confirmed by the directors' report for 1914, which records gross receipts from interest, dividends, etc., amounting only to £46,000 as contrasted with £110,000 in 1913. After providing for depreciation and interest on loans of £916,000, the net profits are returned at £4,600, which sum has been carried forward, as compared with £63,000 in 1913, when a distribution at the rate of 5½ per cent. on the ordinary capital was made.

*The Sweiz. Gesellschaft fur Elektrische Industrie, of Basle,* which is a Swiss investment company whose sphere of activity extends to several countries, and which is associated with the group of the Siemens & Halske Co., of Berlin, reports that the company participated in 1914 in the increases in capital made by the Italian Moncenisio Hydraulic Power Co., the Petrograd Electric Lighting Co., and the Siemens Elektrische Betriebe. In addition, an augmentation took place in underwriting holdings by subscribing to new shares in various Italian and Russian companies, whilst a reduction was effected in the case of the Baku Power Co. The gross profits amounted to £193,000, as compared with £180,000 in 1913, and the net profits were £69,300, as against £69,600. A dividend of 7 per cent. has been declared on the share capital of £800,000 as in the preceding year, the total loan capital reaching £2,400,000.

### German Electrical Companies.

*The Ges. fur Elektrische Hoch und Untergrundbahnen, of Berlin,* proposes to pay a dividend of 4¼ per cent. for 1914 on the ordinary fully-paid shares of £2,500,000, as against 6 per cent. in the preceding year, and the same rate on shares of £500,000 upon which 25 per cent. has been paid.

The accounts of the *Norddeutsche Seekabelwerke, of Nordenham,* after setting aside £9,100 for depreciation in 1914, as compared with £24,000 in the previous year, are reported to show a loss of £11,000, as contrasted with profits of £37,000 in 1913, on a share capital of £300,000. A year ago the dividend paid was at the rate of 5 per cent.

*The Elektrotechnische Fabrik Max Schorch & Co.,* whose dividend of 12 per cent. for 1914, as against 8 per cent. in 1913, has already been announced, reports that working was fully maintained on the outbreak of the war in so far as workmen were not called up. The company had provided itself with an abundance of raw materials, and was therefore still able to carry out orders at comparatively favourable prices at the end of the year. The net profits amounted to £15,000, as contrasted with £11,000 in 1913. The methods of manufacturing had been accommodated to the prevailing conditions, and at the present time a larger number of workmen is employed than at any other period.

The report of the *Deutsche Kabelwerke A.G., of Berlin-Lichtenberg,* states that the undertaking was well employed during 1914 and earned larger profits than in the preceding year, these amounting to £98,000, as compared with £89,000. After deducting general expenses, taxes and interest charges and placing £14,000 to depreciation, as contrasted with £12,000, there remain net profits of £41,000, as against £34,000 in 1913. It is proposed to set aside for additional depreciation the sum of £11,000 for the machinery account, which will represent the final writing-down to one shilling of all the capital expenditure, except for sites and buildings. The sum of £4,000 has been allocated to the special reserve fund and £3,700 to a war risks' reserve fund, and the balance permits of the payment of a dividend of 6 per cent., as compared with 8 per cent. for 1913.

The directors of the *Sachsenwerk, Licht und Kraft A.G., of Dresden,* state that production and turnover of the workshops, which at the beginning of the war materially exceeded those which prevailed in the corresponding period in 1913, were not very considerably less at the close of 1914 than in the previous twelve months. As gross profits the accounts show the sum of £66,000, as against £55,000 in 1913, and of the former the amount of £19,000 has been applied to depreciation, as compared with £12,500, and £15,000 been placed to the reserve fund, as compared with £18,000. The balance allows of the distribution of a dividend of 8 per cent. as against 7 per cent. in 1913. It is added that the prospects for the current year do not appear unfavourable, as orders for electrical machinery and apparatus are arriving very satisfactorily, whilst the large Army orders render it possible to maintain working in the shops without any restrictions.

**Indian Electric Supply and Traction Co., Ltd.**—The directors' report for 1914 shows that the surplus on the year's working in Cawnpore, including £187 for interest accrued, was £12,724 (against £10,145 in 1913), and including further interest in England and transfer fees, the credit side of net revenue account shows a total of £12,758; London expenditure was £1,537 (against £1,335 in 1913), and after providing £3,856 for debenture interest a net profit of £7,365 is shown. The amount brought in from last year being £940, there remains £8,305, of which the directors have placed £3,000 to reserve and £687 against the expenses of the debenture issue. They recommend the payment of a dividend of 5 per cent. for the year, which will absorb £3,901, and that the balance of £717 be carried forward. In February, 1914, a further amount of £5,000 of the 6 per cent. debentures was issued, making the total outstanding £65,000, and leaving £10,000 available for future requirements. The increase in London expenditure arises from payment of the directors' commission on the 1913 dividend, and from the low rates of exchange which have ruled during the war. The increase in debenture interest is due to the fresh issue previously referred to. Mr. D. Cruickshank, who has been a director since the formation of the company, has retired owing to ill-health, and the board have appointed in his stead Sir George Henry Sutherland.

Annual meeting: April 22nd.

**Guildford Electricity Supply Co., Ltd.**—Mr. H. P. Smallpeice presided at the annual meeting held recently. He said that the gross receipts showed an increase of £571. The exceptional circumstances of the latter part of 1914 had, to some extent, modified the profits which they had hoped to make. After referring to the increases which had occurred in oil, waste, water and engine-room stores (£537, as against £279), wages at generating station (£885, as against £680), rates and taxes (£575, as against £405), salaries of engineer, secretary and clerks (£781, as against £519), he said that the result of their appeal against the increased assessment was eminently satisfactory, a considerable reduction having been made. Considering all the circumstances they must congratulate themselves upon being able to write off £1,000 in respect of depreciation, put £250 to reserve, and pay 5 per cent. ordinary dividend, a rate which they had been able to pay for the last five years. In reply to questions, the chairman said that it was unlikely that they would require any additional machinery for the next two or three years. Reference was made to the devotion to their work of the engineer (Mr. H. L. Alderton) and the secretary (Mr. R. H. Piper). Mr. Alderton, in responding, said that the past three months had been exceptionally difficult owing to the shortage of coal, but they had managed to get through.

**Winnipeg Electric Railway Co.**—The report for 1914 states that the gross earnings amounted to $4,101,302, in comparison with $4,078,694 for the previous year. The expenses of operation, including maintenance, repairs and renewals, amounted to $2,416,209, against $2,252,607. The net earnings from operation therefore amounted to $1,685,093. Of this amount the fixed charges, including 5 per cent. on gross earnings payable to the city of Winnipeg, interest on the funded debt, and other fixed charges, absorbed $690,482, leaving a surplus for the year of $994,611 to be added to the balance brought forward from the previous yeaf of $901,698, making together $1,896,309. The usual quarterly dividends, at the rate of 12 per cent. per annum, were paid, amounting to $1,080 000, leaving a balance at the credit of profit and loss account of $816,309.—*Times.*

**Great Northern Telegraph Co., Ltd., of Denmark.**—At the general meeting, which will be held at Copenhagen on May 8th, the board will propose to pay a total dividend and bonus of 22 per cent. for the year 1914, including the 5 per cent. already paid, and to transfer to the reserve and pension funds the following amounts, namely, £111,111 and £11,111 respectively.

**Sao Paulo Tramway, Light and Power Co., Ltd.**—The directors have declared a dividend of 2½ per cent. on the capital stock.

**Minehead Electric Supply Co., Ltd.** — Mr. H. D. Leather presided at the recent annual meeting. He said that the year was, on the whole, satisfactory. Receipts had increased, but the average price per unit was a little down, owing to increased sales for heating and cooking, &c. The works costs showed a saving, and their cost per unit was decidedly less than that of any other works of similar size. They had added £1,000 to depreciation and reserve, and he hoped that as years went by they would be able to build up a strong reserve fund. He would not prophesy as to the future, but the first quarter of the year showed an improvement on last year. The thanks of the meeting were given to Mr. Swarbrick (the secretary) and the staff.

**Provincial Cinematograph Theatres, Ltd.**—For the year ended January 31st, 1915, the net trading profit was £67,587, or £6,637 better than last year. The total distribution on the ordinary shares is 15 per cent., as against 20 per cent. for the previous year, and £9,416 is carried forward as compared with £1,131 brought in. Although the profits are larger and the theatres continue to do excellent business, a smaller dividend is declared, as a conservative policy during the continuation of the war is desirable. Two of the directors and 120 employés have joined H.M. Forces. All appointments are being kept open, and allowances made to dependents.

**Canadian General Electric, Ltd.**—The report for the past year states, says the *Financier*, that the profit amounted to $914,527 (against $2,029,899 in 1913), and, after deducting interest on borrowed capital, $190,957, the net profit before providing for depreciation amounted to $723,571. Dividends paid absorbed $696,741, leaving a surplus for the year of $26 830, to which is added $913,932 undivided profits at December 31st, 1913, and reserve $2,700,000, making the surplus in the balance-sheet $3,640,762. Dividends for the year on the Common stock amounted to 7 per cent., against 7 per cent. and a bonus of 1 per cent. in 1913.

**Paignton Electric Light Co., Ltd.**—At the annual meeting on Monday it was reported that the net profit on the year was £720. The directors had written off £491, the remaining balance on net revenue account, and were carrying forward £229. Forty-two new consumers had been connected during the year, and the whole of the machinery and plant was reported as working very satisfactorily. The Chairman (Mr. W. J. Ham) said there was every prospect of a dividend next year.

**Official Notices re Companies.**—The following companies will be struck off the register at the expiration of three months, unless cause is shown to the contrary :—

Automatic Telephone Co.
Globe Code Co.
Illuminated Signs.
New Imperial Electric Lamp Co.
*Sudd Fuel (Suddite) (registered September 4th, 1911).
*West India and Panama Telegraph Co. (registered July 30th, 1869).
*Other companies with these names still exist.

**Indo-European Telegraph Co., Ltd.**—The directors recommend a dividend for the six months ended December 31st, 1914, of 17s. 6d. per share (making, with the interim dividend already paid, 6 per cent. for the year) and a bonus of 20s. per share, both free of income-tax ; also a special distribution of 15s. per share, free of income-tax, out of interest accrued during the year upon certain investments and advance accounts.

**Western Union Telegraph.**—The report for 1914 shows gross revenue and income $47,287,388, from which must be deducted operating expenses, including rent for leased plant, taxes, &c., $40,578,750, leaving a net income of $6,708,638. Interest on bonds has absorbed $1,337,243, leaving a balance of $5,371,395.—*Financial Times.*

**New Issue.**—*The London Electric Supply Corporation, Ltd.*, is inviting its shareholders to subscribe for £100,000 4 per cent. first mortgage debenture stock at 85 per cent., to meet overdrafts in connection with the L.B. and S.C. Railway power contracts and the general advance in demand for industrial supply.

**Vickers, Ltd.**—The directors have decided to place £250,000 to general reserve and to recommend a final dividend of 1s. 6d. per share (free of income-tax) on the ordinary shares, making 2s. 6d. per share, or 12½ per cent. for the year. £228,876 is carried forward.

**Direct United States Cable Co., Ltd.**—Final dividend of 2s., less income-tax at 2s. 1d. in the £, payable 30th inst., making, with the three interim dividends already paid, a total distribution of 4 per cent. for the year ended March, 1915.

**Monte-Video Telephone Co., Ltd.**—Interim dividend for the half-year ended January 31st last at the rate of 6 per cent. per annum on the ordinary shares.

**Kalgoorlie Electric Power and Lighting Corporation, Ltd.**—The directors have declared a dividend on the preference shares at the rate of 4 per cent. per annum for the six months ended March 31st, 1914.

**Brazilian Traction, Light and Power Co., Ltd.**—The directors have declared a dividend of 1½ per cent. on the issued ordinary capital stock.

## STOCKS AND SHARES.

Tuesday Evening.

While a trifle erratic, the course of the Stock Exchange markets during the past few business days has been upward on the whole. In certain sections, more especially that for rubber shares, business is active and prices are buoyant. In American Rails, too, has occurred such a boomlet as the Stock Exchange has not seen for a year or two. As regards these last, most of the shares now changing hands are being bought by the neutrals on the other side of the Atlantic; and the quaint position will arise of no American shares being good delivery on this side before very long, except such as have been held in physical possession within the United Kingdom for six months past.

Various new issues are being made by companies able to show good cause for raising money at the present time. In the electric lighting market, for instance, a debenture issue has been sanctioned by the Treasury in favour of the London Electric Supply Co. The money is needed in order to cope with the demand from the Brighton Railway for power on the electrified portion of its system, and at 85, this 4 per cent. debenture stock is attractive largely because it is redeemable definitely at par, in 1931, instead of being redeemable at the option of the company, as in so many other cases.

There is a continuance of the demand for first-class telegraph stocks and shares, and the amount of high-grade debenture stocks, for example, which is available to purchasers is almost absurdly small. One indirect result of the Treasury's refusal to sanction new issues *ad lib.* is to force up the quotations of existing securities, because the investor is of such a nature as a rule that he insists upon having a certain stock and no other, and will pay several points more for his particular fancy than for some other stock, equally sound, about which he has less knowledge. The which is natural enough, though it leads occasionally to such anomalies in quotations as the newspapers love to discover and proclaim.

The Home Railway market is still one of the most stagnant in the House. Labour demands remain the chief bugbear of investors who might otherwise be disposed to look with a favourable eye upon the low prices to which most of the erstwhile popular stocks have descended. So far as the electrical issues are concerned, there is next to nothing going on; but within the past few days something like a free market has sprung up in London Electric ordinary shares, which are changing hands pretty freely on the basis of 31s. middle. There are inquiries, too, for the Company's debenture and preference stocks; but the other members of the electric railway group are neglected.

Brazilian Tractions have benefitted substantially from the declaration of another quarterly dividend at the usual rate of 1¼ per cent. on the common shares. The price rose 5½ to 59 last Saturday, came back a dollar or two in consequence of the persistent shrinkage in the Rio exchange, and again recovered. Even at the present price, the yield on the shares works out to about 10¼ per cent. on the money; and it is not a little curious that the sharp rise which has occurred within the past few weeks should have had the result of tempting so few sales of the profit-taking order.

Brazilian Tractions have benefited substantially from the land. Sales on behalf of Dutch proprietors are prohibited, under the Treasury regulations; while with respect to the unhappy Belgians, only such realisations are permitted as are certified to be for account of refugees requiring comparatively small sums of money with which to maintain the absolute necessities of life. With these sources of supply of shares thus cut off, and with the market now in strong hands, it may be easily seen how a little demand from fresh buyers has the effect of advancing the price rapidly.

Mexico Tramways Fives are 5 points better, and in spite of apparently discouraging news from the country, most Mexican securities have advanced this week, several of the railway stocks securing big rises.

In view of the more settled conditions of Stock Exchange markets, it has been decided to resume in a limited degree the particulars which used to be given here, before war broke out, in regard to the yields obtainable from securities quoted in our lists. The argument against such a course is that many quotations are still somewhat nominal, and that yields worked out upon nominal prices might here and there be deemed misleading. In a way, of course, this argument applied even before the war, for in those days not all the stocks were to be sold, while certain others could not be bought, and this condition of affairs varied from week to week. Weighing pros and cons, however, the present seems to be opportune for re-establishment of tables of yields, and we accordingly add these figures to our lists of prices. For correction of what error may have crept into the figures we shall be grateful—which invitation, by the way, is not so much a confession of carelessness in compilation as an acknowledgment that the most painstaking efforts are not infallible in their results.

With which apologia in advance, we set out the usual list of representative securities; from these are eliminated the end-July prices, which seem to have less practical interest than the yields obtainable at current levels. At the same time, it may be added that, should any reader wish to know the pre-war price of any electrical issue, a post-card inquiry will be answered with pleasure :—

| | Dividend, 1914. | April 13, 1915. | Rise or fall this week. | Yield p.c. |
|---|---|---|---|---|
| **Home Electricity Companies.** | | | | |
| Brompton Ordinary | 10 | 8½ | — | £6 1 8 |
| do. 7 per cent. Pref. | 7 | 7⅞ | — | 4 10 4 |
| Charing Cross Ordinary | 5 | 4½ | — | 5 11 1 |
| do. do. do. 4½ Pref. | 4½ | 4⅜ | — | 5 9 1 |
| do. do. City Pref. | 4½ | 4 | — | 5 12 6 |
| do. 4 Deb. | 4 | 90 | — | 4 9 0 |
| Chelsea | 5 | 4⅝ | — | 5 8 1 |
| do. 4½ Deb. | 4½ | 92 | — | 4 17 10 |
| City of London | 9 | 14½ | — | 6 4 2 |
| do. do. 6 per cent. Pref. | 6 | 12⅛ xd | — | 4 16 0 |
| do. do. 5 Deb. | 5 | 112 | — | 4 9 3 |
| do. do. 4½ Deb. | 4½ | 98 | — | 4 11 10 |
| County of London | 7 | 11⅜ xd | — | 6 3 1 |
| do. do. 6 per cent. Pref. | 6 | 11⅜ | + ⅛ | 5 5 6 |
| do. do. 1st Deb. | 4½ | 100 | — | 4 10 0 |
| do. do. 2nd Deb. | 4½ | 97 | — | 4 12 9 |
| Kensington Ordinary | 9 | 7 | — | 6 8 7 |
| London Electric | 4 | 1⅞ | — | 6 18 0 |
| do. do. 6 per cent. Pref. | 6 | 5 | — | 6 0 0 |
| do. do. 4 Deb. | 4 | 87 | — | 4 12 0 |
| Metropolitan | 8½ | 8 | — | 5 16 8 |
| do. 4½ per cent. Pref. | 4½ | 4 | — | 5 12 6 |
| do. 4½ Deb. | 4½ | 94 | —2 | 4 15 9 |
| do. 3½ Deb. | 3½ | 80 | — | 4 7 6 |
| St. James' and Pall Mall | 10 | 8 | — ½ | 6 5 0 |
| do. do. do. 7 per cent. Pref. | 7 | 6⅝ | — | 5 9 10 |
| do. do. do. 3½ Deb. | 3½ | 80 | — | 4 7 6 |
| South London | 5 | 3 | — | 6 18 4 |
| South Metropolitan Pref. | 7 | 1⅛ | — | 6 4 5 |
| Westminster Ordinary | 9 | 7½ | — | 6 0 0 |
| do. 4½ Pref. | 4½ | 4⅜ | — | 4 12 4 |
| **Telegraphs and Telephones.** | | | | |
| Anglo-Am. Tel. Pref. | 6 | 10½ | + ½ | 5 15 0 |
| do. Def. | 1⅜ | 22 | + ¼ | 6 16 4 |
| Chile Telephone | 8 | 6⅝ | — | 6 0 9 |
| Cuba Sub. Ord. | 5½ | 8⅛ | — | 6 5 9 |
| do. Pref. | 10 | 15 | — | 6 13 4 |
| Eastern Extension | 7 | 13 | — | 5 7 8 |
| do. 4 Deb. | 4 | 92 | — | 4 7 0 |
| Eastern Tel. Ord. | 7 | 134 | +2 | 5 4 6 |
| do. 3½ Pref. | 3½ | 73½ | — | 4 15 3 |
| do. 4 Deb. | 4 | 93 | — | 4 7 0 |
| Globe Tel. and T. Ord. | 6 | 11⅜ | + ¼ | 5 4 4 |
| do. Pref. | 6 | 12 | — | 5 0 0 |
| Gt. Northern Tel. | 20 | 29 | — | 6 18 0 |
| Indo-European | 65/- | 51 | — | 6 7 6 |
| Marconi | 20 | 1⅝ | — | 10 18 4 |
| New York Tel. 4½ | 4½ | 99½ | — | 4 10 8 |
| Oriental Telephone Ord. | 10 | 2 | — | 6 0 0 |
| do. Pref. | 6 | 1⅜ | — | 5 1 1 |
| Tel. Egypt Deb. | 4½ | 88½ | — | 5 1 8 |
| United R. Plate Tel. | 8 | 6½ | + ½ | 6 8 0 |
| do. Pref. | 5 | 5 | — | 5 0 0 |
| West India and Pan. | 1½ | 1½ | + 1/32 | 5 0 0 |
| Western Telegraph | 7 | 13⅛ | — | 5 4 8 |
| do. 4 Deb. | 4 | 93 | — | 4 6 0 |
| **Home Rails.** | | | | |
| Central London, Ord. Assented | 4 | 77 | — | 5 4 0 |
| Metropolitan | 1½ | 29½ | + ½ | 4 4 9 |
| do. District | Nil | 17½ | + ½ | Nil |
| Underground Electric Ordinary | Nil | 1⅛ | — | Nil |
| do. do. "A" | Nil | 5/6 | — | Nil |
| do. do. Income | 6 | 81½ | — | 7 7 3 |
| **Foreign Trams, &c.** | | | | |
| Anglo-Arg. Trams, First Pref. | 5½ | 4½ | — | 6 9 5 |
| do. 2nd Pref. | 5½ | 3¾ | — | 7 2 0 |
| do. 4 Deb. | 4 | 84 | — | 4 15 3 |
| do. 4½ Deb. | 4½ | 90 | — | 5 0 0 |
| do. 5 Deb. | 5 | 89 | +1 | 5 12 4 |
| Brazil Tractions | 6 | 59 | +5½ | 10 3 4 |
| Bombay Electric Pref. | 6 | 10⅜ | — | 5 16 10 |
| do. 4½ Deb. | 4½ | 91 | — | 4 19 0 |
| Mexico Trams | Nil | 80 | — | Nil |
| do. 5 per cent. Bonds | Nil | 60 | +5 | Nil |
| do. 6 per cent. Bonds | Nil | 80 | — | Nil |
| Adelaide Sup. 6 per cent. Pref. | 6 | 5¼ | — | 5 14 3 |
| do. 5 Deb. | 5 | 103 | — | 4 17 1 |
| **Manufacturing Companies.** | | | | |
| British Westinghouse Pref. | 7½ | 2 | — | 7 10 0 |
| do. 4 Deb. | 4 | 72 | — | 5 11 1 |
| do. 6 p. lien | 6 | 99 xd | — | 6 1 3 |
| Callenders | 15 | 12 | — | 8 6 8 |
| do. 5 Pref. | 5 | 4⅜ | — | 5 2 7 |
| do. 4½ Deb. | 4½ | 98 | — | 4 12 4 |
| Castner-Kellner | 15 | 8⅞ | — | 4 14 1 |
| Edison & Swan, £9 pd. | Nil | 14/6 | — | Nil |
| do. do. fully paid | Nil | 2¼ | — | Nil |
| do. do. 4 Deb. | 4 | 63 | — | 6 7 0 |
| do. do. 5 % Deb. | 5 | 60 | — | 8 6 8 |
| Electric Construction | 5 | 13/6 | —3d. | 7 5 6 |
| do. do. Pref. | 7 | 1 | — | 7 0 6 |
| Gen. Elec. Pref. | 6 | 10 | — | 6 0 0 |
| Henleys | 20 | 14½ | — | 6 18 0 |
| do. 4½ Pref. | 4½ | 4⅛ | — | 4 13 4 |
| do. 4½ Deb. | 4½ | 97 | — | 4 11 9 |
| India-Rubber | 5 | 9⅛ | — ⅛ | 5 9 7 |
| Telegraph Con. | 20 | 87 | — | 5 8 6 |

This week's dividend declarations in the Telegraph market have had no effect upon prices, but it is satisfactory to find the Direct United States Company paying the usual 4 per cent. on its ordinary shares, while the Indo-European declares the regular 6 per cent. dividend, 20s. bonus, and 17s. 6d. special distribution, bringing the whole amount up to the usual payment. Prices are firm, and there are improvements in half-a-dozen of the leading shares. Marconis went back to 1 13/16, recovering, however, to 1⅞ buyers. American Marconis have sympathised with the strength of the American railroad market, and are up to half-a-guinea, though Canadians lag behind at just half this price.

The Manufacturing group is steady, with a good deal of business doing without alteration of prices. The Potteries Electric Traction Co. has declared a dividend of 2½ per cent. on its ordinary shares. The rubber market is still very active, although the rush of last week has subsided to a slight extent. Stock Exchange men engaged in this market find their hands full of work—much of it unremunerative, in consequence of the low prices of shares and the trifling brokerage chargeable, though the amount of work involved is actually more than would be the case in higher-priced stocks. Prices on the whole are keeping extremely firm; and with America a more ready buyer of rubber, there is nothing unreasonable in the assumption that the produce may further improve in price. The Armament group has been favourably affected by the declaration of a dividend on Vickers, making 12½ per cent. for the year, the same as that in the previous twelvemonth. At the present price, Vickers pay 7½ per cent. on the money.

The Stock Exchange has issued its own report within the past few days, showing a decrease in receipts of £25,000, an increase of expenses amounting to £9,800, with a cut in the final dividend from £6 to £3 per share. Electric power, working expenses and maintenance are charged in the accounts at £1,656, a decrease of £330 as compared with the previous year. It has been mentioned here before that the Stock Exchange has an electric light plant of its own, so it may be well imagined that the recent coal crisis gave the managers some anxious moments.

## MARKET QUOTATIONS.

**It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.**

### Wednesday, April 14th.

| CHEMICALS, &c. | | Latest Price. | Fortnight's (inc. or Dec. |
|---|---|---|---|
| a Acid, Hydrochloric | per cwt. | 4/6 | .. |
| a " Nitric | " | 19/- | .. |
| a " Oxalic | per lb. | .. | .. |
| a " Sulphuric | per cwt. | .. | .. |
| a Ammoniac Sal | " | £49 | .. |
| a Ammonia, Muriate (large crystal) | per ton | £40 | .. |
| a Bleaching powder | " | £9 | .. |
| a Bisulphide of Carbon | " | £21 | .. |
| a Borax | " | £22 | .. |
| a Copper Sulphate | " | £29 | .. |
| a Lead, Nitrate | " | £35 | .. |
| a " White Sugar | " | .. | .. |
| a " Peroxide | " | .. | .. |
| a Methylated Spirit | per gal. | .. | .. |
| a Potassium, Bichromate, in casks | per lb. | 6d. | .. |
| a Potash, Caustic (88/90 %) | per ton | .. | .. |
| a " Chlorate | per lb. | 1/6 | .. |
| a " Perchlorate | " | 1/6 | .. |
| a Potassium, Cyanide (98/100 %) (for mining purposes only) | " | Nom. | .. |
| a Shellac | per cwt. | 65/- | .. |
| a Sulphate of Magnesia | per ton | .. | .. |
| a Sulphur, Sublimed Flowers | " | £11 10 | .. |
| a " Recovered | " | £8 | .. |
| a " Lump | " | £8 10 | .. |
| a Soda, Caustic (white 70/72 %) | " | £10 2 6 | .. |
| a " Chlorate | per lb. | 10½d. | .. |
| a " Crystals | per ton | 45/- | .. |
| a Sodium Bichromate, casks | per lb. | 3¼d. | .. |
| **METALS, &c.** | | | |
| Aluminium Ingots, in ton lots | per ton | £90 | .. |
| " Wire, in ton lots (1 to 14 S.W.G.) | " | £120 | .. |
| b " Sheet, in ton lots | " | £150 | .. |
| p Babbitt's metal ingots | " | £50 to £221 | .. |
| c Brass (rolled metal 2" to 12" basis) | per lb. | 10d. | ½d. inc. |
| c " Tube (brazed) | " | 1/- | 1d. inc. |
| c " (solid drawn) | " | 10½d. | ½d. inc. |
| c " Wire, basis | " | 10½d. | ½d. inc. |
| c Copper Tubes (brazed) | " | 1/0½ | ½d. inc. |
| c " " (solid drawn) | " | 1/0½ | ½d. inc. |
| g " Bars (best selected) | per ton | £94 | £4 inc. |
| g " Sheet | " | £94 | £4 inc. |
| g " Rod | " | £94 | £4 inc. |
| d " (Electrolytic) Bars | " | £80 | £3 inc. |
| d " " Sheets | " | £98 | £3 inc. |
| d " " Rods | " | £86 | £3 inc. |
| d " " H.C. Wire | per lb. | 10½d. | ¾d. inc. |
| f Ebonite Rod | " | 3/- | .. |
| f " Sheet | " | 2/6 | .. |
| n German Silver Wire | " | 1/8 | .. |
| h Gutta-percha, fine | " | 6/10 | .. |
| h India-rubber, Para fine | " | 2/7 | 1½d. inc. |
| l Iron Pig (Cleveland warrants) | per ton | 67/- | 8/6 inc. |
| l " Wire, galv. No. 8, P.O. qual. | " | £18 | .. |
| g Lead, English Pig | " | £21 15 | £2 5 dec. |
| m Manganin Wire No. 28 | per lb. | .. | .. |
| g Mercury | per bot. | £12 to £12 5 | .. |
| e Mica (in original cases) small | per lb. | 4d. to 2/6 | .. |
| e " " " medium | " | 3/- to 5/- | .. |
| e " " " large | " | 6/6 to 10/6 & up. | .. |
| o Nickel, sheet, wire, &c. | " | Nom. | .. |
| p Phosphor Bronze, plain castings | " | 1/1 to 1/3½ | .. |
| p " " rolled bars & rods | " | 1/3 to 1/3½ | .. |
| p " " rolled strip & sheet | " | 1/3½ to 1/6½ | .. |
| o Platinum | per oz. | 185/- | .. |
| d Silicium Bronze Wire | per lb. | 10½d. | .. |
| r Steel, Magnet, in bars | per ton | £70 | .. |
| g Tin, Block (English) | " | £172 | £1 dec. |
| n " Wire, Nos. 1 to 16 | per lb. | 2/8 | 2d. inc. |
| p White Anti-friction Metals | per ton | £52 to £194 | .. |
| k Zinc, Sh's (Vieille Montagne bnd.) | " | Nom. | .. |

**Quotations supplied by—**

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

## THE FRENCH ELECTRICAL ENGINEERING INDUSTRY AND ITS FUTURE.

At a recent meeting of the Société d'Encouragement de l'Industrie Nationale, held in Paris, an instructive address was given by M. Hillairet, on the capability of France to meet the demand for electrical machinery and material. The paper was accompanied by a number of statistical tables, some of which are reproduced herewith.

Dealing first with that relating to the importation of electrical material into France, it may be noted that, although less than in 1912, France still makes relatively large purchases of carbons; these have hitherto mainly come from Germany and Austria, and are chiefly intended for arc lamps; the decline that has taken place in the importation is principally due to the increasing popularity of metal-filament lamps. Great Britain and even America have, it was pointed out, also hitherto procured part of their requirements in arc-lamp carbons from Germany, largely owing to the fact that they have been obtainable at lower figures than those demanded for the home-produced goods. M. Hillairet considers that, as regards arc lamp carbons, the four or five French works producing them could not only meet the German competition but even overcome it, were they to organise their establishments on a truly industrial and economic basis.

French Imports of Electrical Material.

| | 1913. | 1912. | 1911. |
|---|---|---|---|
| Carbons for electrical purposes... | £42,640 | £46,080 | £26,360 |
| Incandescent lamps—carbon filaments... ... ... | 2,000 | 5,000 | 16,960 |
| „ Metal-filaments... ... | 87,440 | 135,760 | 130,920 |
| „ Unmounted filaments ... | 14,280 | 240 | 240 |
| Dynamos ... ... ... ... | 382,330 | 353,320 | 370,720 |
| Electrical and electro-technical machinery and apparatus ... | 700,200 | 677,600 | 573,380 |
| Dynamo parts ... ... ... | 440 | 2,360 | 5,720 |
| Insulated wires and cables ... | 65,200 | 24,010 | 23,120 |
| Armatures and detached parts of same ... ... ... ... | 184,480 | 150,080 | 122,240 |
| Arc lamps and parts of same ... | 3,200 | 5,000 | 7,320 |
| Magnets ... ... ... ... | 13,120 | 8,160 | 6,680 |
| Accumulators and parts of same | 7,160 | 10,600 | 9,440 |
| Dry batteries ... ... ... | 5,689 | 32,160 | 1,120 |

As will be seen, there was a falling-off in the importation of incandescent lamps in 1913. This was due to the fact that several works had been established in France capable of turning out 100,000 tungsten lamps per day, which gave rise, in M. Hillairet's mind, to the hope that by concentrated effort French manufacturers would soon succeed not only in meeting the requirements of the home market but also in building up a foreign trade.

The increase in the importation of armatures and magnets in 1913 is explained by the development of the French automobile industry which is a large user of such parts in connection with the ignition mechanism on petrol cars. As for dry batteries, Germany has inundated the shops, both large and small, throughout France with these in conjunction with small pocket electric lamps.

Passing to the exports of electrical material from France, these for the years 1913, 1912 and 1911 are shown below:—

French Exports of Electrical Material.

| | 1913. | 1912. | 1911. |
|---|---|---|---|
| Carbons for electrical and industrial uses ... ... | £428,200 | £311,440 | £210,646 |
| Incandescent lamps ... ... | 71,520 | 64,760 | 68,400 |
| Dynamos and transformers ... | 164,600 | 119,520 | 186,720 |
| Electrical apparatus ... ... | 583,480 | 422,960 | 369,280 |
| Dynamo parts ... ... ... | 40 | 120 | 280 |
| Armatures and component parts | 98,400 | 131,560 | 110,880 |
| Insulated wires and cables ... | 136,640 | 118,200 | 142,200 |
| Arc lamps ... ... ... | 11,920 | 43,480 | 123,040 |
| Magnets ... ... ... ... | 160 | 40 | 40 |
| Accumulators and parts of same | 20,920 | 23,560 | 16,760 |

Resulting, no doubt, from the growing demand for electrodes for electrotechnical purposes, the exports of carbons from France have shown a steadily expanding tendency. In the case of the insulated wire and cable industry, the trade showed an improvement over 1912, although the export total recorded in 1911 was not reached. The decrease in arc lamp shipments finds its explanation in the increasing favour that is being shown towards high-intensity low-consumption metal-filament lamps. It is unnecessary to consider the tables further, as, after all, figures relating to imports and exports have only a relative value. M. Hillairet endeavoured to supplement them by an estimate, or rather an under-estimate, as he termed it, of the annual production of the French electrical industry, his figures being as follows:—

| | |
|---|---|
| Dynamos, transformers, &c. ... ... ... | £2,664,000 |
| Electric lamps and fittings ... ... ... | 2,680,000 |
| Electric wires, cables and materials for mains | 1,600,000 |
| Telegraph, telephone and electrical measuring instruments ... ... ... ... | 1,040,000 |
| Accumulators, primary batteries, insulators and miscellaneous material ... ... | 856,000 |
| | £8,840,000 |

In M. Hillairet's opinion these figures show that, with a full determination, combined with suitable action, some form of common objective between manufacturers, a wide view of commercial opportunities, a desire to meet the wishes and requirements of consumers, and with suitable endeavours to educate and instruct the latter in modern applications of electricity, French electrical material would not only be more widely used at home, but would find its way into foreign markets, both those near at hand and distant. In the lecturer's opinion France is already in possession of all the elements necessary for such an industrial development. Thirty years ago, at the outset of important applications of electricity, the position was vastly different—skilled labour was not available; raw material was not readily forthcoming; dynamo castings and armatures were made of cast-iron; the correct conditions of their use were not known; and the available steels varied greatly in their carbon content. To-day, thanks, to a large extent, to the Robert process, the progress in steel manufacture at the Creusot and Chatillon-Commentry and other works has been such that it is possible to obtain steel plates and sheets of a definite and exactly regular thickness, and precise composition and quality. The losses due to Foucault currents and hysteresis can be accurately determined and verified by actual tests. Wire mills and cable works are able to turn out material that will meet the most stringent specifications. In a word, electrical engineers now work in a well-explored field that leaves little or no scope for unexpected happenings.

France, indeed, the author claimed, now possesses everything necessary to permit of the extension and development of the electrical engineering industry in the country. He even anticipated the statement which is usually advanced, that the cost of skilled labour in France is higher than in other countries, by pointing out that this was not so serious as it was usually represented, it being only, comparing one of the largest works in France with the labour cost in Germany, the difference between the pfennig and the centime.

To make this clear, it may be stated that 1 pfennig is equal to, approximately, 1·2 centime, and that our shilling is equal to about 104 pfennigs or 125 centimes.

According to M. Hillairet, this difference can be disregarded, as, in his opinion, the cost of labour is the least important of the elements that constitute cost of production, his estimate of this being:—Labour, 20 per cent., raw material, from 50 to 60 per cent., and general expenses, from 20 to 30 per cent.

What the lecturer considered a much more important matter was the impetus that the improvement in technical methods was giving to practical applications of electricity. Originally, electrical engineering work was carried on very much in an empirical rule-of-thumb fashion, which has been largely overcome, and M. Hillairet looks forward, in the not far distant future, to seeing technical education included in the curriculum of French Universities.

The first electro-technical institute on French lines was that which, thanks to the liberality of M. Montefiore Lévy, was established in Liége (Belgium), and at the head of which is M. Eric Gerard, whose teaching has had very valuable and far-reaching results, his students coming from all countries. The Liége Institute has, as a matter of fact, served as the model for those that have since been

started in France:—The Ecole Centrale, the electro-technical schools at Grenoble, Lille and Nancy, the Laboratory and the Ecole Supérieure d'Electricité, of Paris, and the Ecole de Physique et de Chimie. It is from these schools that the French electrical engineering industry is receiving a constant stream of professional recruits.

Capital, raw material, skilled workmen and managers, and commercial leaders—France is now well supplied in all these sections of the problem. The concentration of each of these elements in a common effort should, he considers, give the French electrical engineering industry a prominent position in the world's markets.

Commenting on M. Hillairet's address, M. Dieudonné, in *La Lumière Électrique*, draws attention to some points in connection with which France is not on a level with Germany, which country has hitherto proved the principal competitor in this industry. The support given to new undertakings by the banks in Germany is superior to that in France; the German patent laws, too, are better, while, from the point of view of commercialism and salesmanship, the Germans have shown that they have nothing to learn from other countries, but in this department set an example which could be advantageously followed in France. The success of German electrical engineering concerns, in M. Dieudonné's opinion, is due more to active commercial enterprise than to superior technical knowledge and skill. Indeed, he does not consider that the latter is up to the French level; it may be more sectionised and specialised in Germany, but while he is not an advocate of too wide a course of training, he holds the view that too much specialising in one branch will eventually lead to a drying-up of the springs of reasoning and observation, and so hinder technical progress.

Turning to another aspect of the subject, M. Dieudonné points out that on the termination of the war, French electrical engineers will have an excellent opportunity of demonstrating that they are in a position to cope with the demands that are sure to be made upon them to replace the central stations and other electrical installations that have been damaged or destroyed during the hostilities with model plants, constructed in accordance with carefully-prepared designs and plans, and equipped with the most up-to-date machinery.

## REVIEWS.

*The Electron Theory of Matter.* By Prof. O. W. Richardson. Cambridge: University Press. Price 18s. net.

There are two kinds of physicists, practical and theoretical, but there is, or should be, only one kind of engineer, the practical. That is to say, the practical and theoretical are not distinct, as they may be in physics. So that the engineer is always on the look-out when he reads a book such as this one, which deals chiefly with the theory of its subject, carefully to pick out and lay to one side what he considers the more or less hypothetical portions, and to take a firm grip of those parts which promise help or advantages in actual application. What the future may bring forth to the practical man out of the mysteries of atomic astronomy is problematical, but this much can be said with certainty, that there are vast reservoirs of latent energy locked up in atomic structures, and these structures also hold secrets concerning the origin of electricity, gravitation and matter. And it seems impossible, in view of such certainties, that the engineer of to-day can afford to pass by, without trying to sieve all that is worth having from the labours of those engaged in this department of knowledge and other allied branches of pure science.

Therefore this important work by Prof. Richardson, while it contains too much of the hypothetical and theoretical for most practical men, yet also contains much that is of interest to him.

It is based upon a course of lectures delivered to graduate students at Princeton University. It is, therefore, not an elementary book, and is thus of little use to those whose knowledge of the facts of radioactivity is of a more or less rudimentary nature. Nor is it experimental in character, for it endeavours to deal with known quantities and to amplify and extend them by the tools of mathematics. The writer in general tries to indicate the extent to which the fundamental facts of physical science may be co-ordinated by means of the conception of the electron and the laws of electrodynamics; and with this purpose in view, in consideration of the immense field covered by the subject, he has chosen for the topics to be discussed those which seem of most importance and interest at the present time. References to scientific papers and other works are given wherever necessary.

A considerable portion of the book is occupied by a treatment of the more elementary matters, this treatment, however, being mathematical throughout. It opens with a chapter on the origin of the electron theory, and then goes on to consider electric intensity and potential, dielectric media, magnetism, electromagnetism, electromagnetic waves, dispersion, absorption and selective reflection.

In Chapter IX the fundamental equations of the electron theory are taken in hand. Then there is an important chapter on the æther, in which the question whether the æther is at rest in the neighbourhood of moving bodies is discussed, the Michelson and Morley experiment being described with its negative result and the speculative hypotheses to explain this result. The author mentions that there is no experimental evidence of any optical effects arising from the motion of matter relative to æther or to space, and he is therefore tempted to inquire whether it is really necessary to postulate an æther for the propagation of electrical and optical effects. He discusses at length the principle of relativity, and reviews the bearing of the principle on the question of the existence of a luminiferous æther. He arrives at the conclusion that it furnishes no evidence for or against the existence of an æther, and it denies the possibility of determining the motion of such a fluid, supposing it to exist.

The chapter on "Radiation and Temperature" is very complete, and goes well into the mathematics of the subject, including dissertations on Stefan's Law, Wien's Law, the formula of Rayleigh and Jeans, Planck's Law, and so on.

Perhaps one of the most important parts of the book deals with the equilibrium theory of electronic conductors. This subject is brimful of interest and latent possibilities. Much experimental work has been done upon it, but a vast amount more remains to be done. The author takes the few laws which experiment shows to be true, and, assuming that the emission of electrons from elementary and compound substances is a purely thermal effect, sets out to discover what laws such a phenomenon should be expected to obey.

Chapter XXI on the structure of the atom reviews most of what is known about the matter up to date, and it specially deals with the stability of electronic systems under various hypotheses regarding the unknown positive element.

A chapter on "Gravitation," that most elusive of the mysteries of matter, closes the book. The author truly says that, paradoxical though it may seem, it is quite likely that one of the chief difficulties in the way of a physical theory of gravitation lies in the extreme simplicity of known laws of gravitational action, and that any addition to our knowledge of it by experiment is scarcely to be hoped for on account of the smallness of the forces concerned; these are large enough when we deal with the enormous aggregations of matter familiar to astronomy, but they are exceedingly small with masses which can be controlled in the laboratory.—W. J. C.

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*The Underwar.* By A. Gowans Whyte and T. C. Elder. London: The Electrical Press, Ltd. Price 1s. net.

This is "a reasoned statement of the true strategy involved in the 'War upon Germany's Trade,'" and is intended to show, without political or party motive, what measures are necessary in order to organise victory in the commercial campaign as, we hope and believe, it is being organised in the military struggle. That success can never

be attained by merely proclaiming, and again proclaiming, commercial warfare is a fact to which we have repeatedly called attention in these pages, and the authors drive it home with forceful argument and literary skill. The keynote of the book is unity of purpose—we had almost said co-operation—but it is something more than is conveyed by that expression; energetic action on the part of the Government in support of the manufacturing industries, with a view to providing security for capital invested in new industries and extensions of existing undertakings, statutory provision to ensure that all public money raised in Great Britain shall be spent in Great Britain, improved methods of salesmanship, and the practical support of the workers and their representatives, are the principal features of the authors' plan of campaign. While their proposals are not new in principle, having been advocated in our own columns, for example, for years, their book provides an admirable review of the present situation and of the requirements of the future, bringing together in a handy form the powerful arguments which have hitherto fallen on deaf ears, and concentrating their collective weight upon the mind of the reader. The question of a protective tariff inevitably crops up in the course of the work, but is dismissed as being at present hopelessly entangled with party politics; there are not wanting signs, however, that even strong upholders of Free Trade are willing, in view of the unprecedented circumstances, to modify their views, and to accept the principle of a special tariff designed to prevent the flooding of our market with German goods at knock-out prices when peace is restored. The fact that the Board of Trade at an early stage vigorously (if inexpertly) embarked upon the commercial war is welcomed as an indication that the policy of *laissez faire* with regard to British manufactures has been abandoned, and we may add that the decision of the Government to provide capital for the establishment of dye manufactories in this country marks a new era in this respect. We hope the book will be widely read, and will stimulate its readers to be up and doing—not merely "killing Kruger" with their mouths.

*Electrical Practice in Collieries.* By Daniel Burns, M.Inst.M.E. London: Chas. Griffin & Co., Ltd. Price 7s. 6d. net.

That there is a demand for a practical treatise dealing with the very important question of electrical engineering in mines is evidenced by the fact that this book, first published in 1903, is now in its fourth edition, and we quite agree with the author that "the application of electricity to mining operations extends with such rapidity that it is no easy task to keep a text-book in line with growing practice." The work is divided into ten chapters, dealing respectively with units of measurement, &c.; theory of the dynamo; the dynamo; motors; lighting; pumping; haulage; coal cutting; underground conveyors; and miscellaneous matters.

In our review of the last edition we suggested that the electrical portion of the work might with advantage be improved, and we are sorry to note that the suggestion has not been acted upon; in the present edition there are several illustrations of machines of a bygone age which we should like to see replaced by more up-to-date illustrations of representative machines. We think also, in view of the very great importance of the subject, that the question of "earthing" might be more thoroughly dealt with. We can quite imagine a colliery manager or colliery engineer searching for illumination on this point, and not being much wiser after a search in the present work, and we are convinced that few colliery managers or engineers thoroughly understand "earthing." The author himself admits that the "whole question of earthing is . . . a most important one, and must be so regarded by the responsible person, and 'an efficient earth is not so easily obtained in a colliery as many persons imagine'"; with this we thoroughly agree, and, therefore, we question very much whether the author goes far enough when he says "short of a connection to a line of water pipes or a copper plate of considerable area submerged in water, it is difficult to obtain an absolutely reliable and satisfactory set of conditions." We know that both water pipes and submerged copper plates have been used as "earth" in mines, and in either case with disastrous results. The whole subject of earthing should be thoroughly ventilated, especially in a book of this nature. Again, we should hesitate to recommend any colliery manager to install the "lightning arrester" shown in fig. 6, on any overhead system of wiring. The greater part of Chapter III is devoted to the D.C. dynamo, and the three-phase machine is dismissed in about two pages. The illustration on page 56 described as a "consequent" pole type might be better named, and we would point out that "Parson's turbine" should be spelt Parsons; in connection with steam turbines the test "by Prof. Ewing, of Cambridge (which) gave a steam consumption of 21·2 lb. per electrical horse-power-hour" is rather ancient history, and we question whether even a colliery manager would be satisfied with this consumption. The chapter on motors is also weak, very little attention being given to three-phase machines or switchgear. Generally speaking, the work is weak and more or less out of date from an electrical point of view, and deals more with the mechanical application of electricity; on the whole, here it is good, especially in the parts dealing with pumping, haulage, coal-cutting and underground conveyors. But is this what the colliery manager or engineer wants? We venture to think he is in search of a little more insight into constructive details, and the elucidation of the mysteries of three-phase machines, seeing that these are now in fashion at modern collieries. To the student it undoubtedly forms a valuable text-book, and the several worked-out numerical examples and the questions at the end of each chapter lend an added interest. There is room for the work—it is, in fact, badly wanted—the plan of the book is good and very much that is contained in it is good, but we do think that the electrical portion might with advantage be thoroughly revised and rewritten before a further edition is issued.

## TELEPHONE TROUBLES IN THE TROPICS.

The following discussion took place at the Institution of Electrical Engineers on Mr. Llewellyn Preece's paper on the above subject, an abstract of which appeared in our issue of April 9th, page 508.

Sir John Gavey said he had had some experience of trouble in 30° or 40° South latitude, where there were heavy storms, which fortunately only had ¼-mile front and swept away everything in front of them. Then there was trouble with a bird which built its nest between the cross-arms, and the nest being soaked with moisture caused short-circuits. To overcome this trouble an arrangement of vertical wires was introduced between the arms which obstructed the entrance to the nest. Spiders were also troublesome; there were innumerable small spiders whose webs swept across the wires from pole to pole and caused short-circuits. It had been suggested that they should be swept off, but the mileage ran into thousands. Five species of beetle in the Argentine perforated the lead covering of cables to lay eggs, but did not go into the paper. The author favoured filling joints with compound, which was common in the States, but not in England or South America; it was almost impossible to get an insulating material to expand in unison with the lead, and there was the danger of moisture entering. As regarded staff, the loquacity of the South American, who would exchange compliments with the operators, seriously delayed the services.

Mr. W. Cook said it was difficult to discuss the relative merits of apparatus unless the conditions were specified. He could not understand the author's attitude to the common-battery system—no satisfactory service could be given when the insulation was so low that the common-battery system could not be used; the author was also not quite right in regard to Mahommedan women operators, as these were employed in Constantinople, the only concession to them being a head covering. He was glad to see the remarks in regard to filled joints, as money was often lost by pumping air into the cable, &c.; poles made from discarded steel rails gave satisfactory results, and he had used concrete poles costing half as much as Hamilton poles. The first cost of covered work was often more than compensated for by decreased maintenance. As regarded humidity, some Scarborough records appeared to be almost as bad as those mentioned; at Falmouth 90 per cent. was recorded regularly in the early mornings of July and August.

Mr. W. Slingo, referring to the author's remarks on the magneto system, said the central-battery system had proved its reliability and utility in service, and if difficulties arose steps should be taken to overcome them. The automatic system seemed the most appro-

priate in a place where there was language difficulty, and it was not more difficult to maintain than the common-battery system. Enamelled coils were being tried by the G.P.O., after being subjected to rigorous tests. An automatic telephone for 700 lines had been installed at Simla, and found more popular and rapid in service than the old system, and this was to be extended.

Mr. J. E. Kingsbury said he had thought that experience with enamelled wire would have enabled some troubles to be got over; as an instance, he cited the case of wool-covering of a multiple switchboard cable, which was attacked by moths. He agreed with the author's remarks on solid joints; air drying-out was something of a luxury. Trouble arose at the joints, and the solid joint appeared to get over the difficulty. The author appeared to be taking the risk of allowing primitive man to put up with primitive appliances.

Mr. Weightman said troubles due to heat and humidity were most felt when such conditions were practically constant throughout the year. Red fibre, leather and uralite used in home practice were quite unsuitable in the tropics, although there were areas in the tropics which were infinitely better from the insulation point of view than the temperate zone.

Mr. Laidlaw remarked that the paper covered two-thirds of the globe. Did the author mean that the type of equipment mentioned would be suitable for all localities? Possibly teak was the best wood for use in the tropics. If wires were run through trees, it was possible that the common-battery would not work at all, but even with poor insulation some sort of service could be obtained with a mageto system; each case must be decided on its merits. The author did not prove that enamelled wire was wrong, and probably in moist places the coils could be sealed up and so protected.

Mr. A. J. Stubbs had always been impressed with the difficulty of getting an accurate idea of the troubles of engineers in the Colonies and tropics. If they would carefully report their difficulties, engineers at home could probably assist them. He believed it was usual in the States to have special magneto extensions for long distances; they did not attempt to use the common-battery system for that purpose.

Mr. McAlpine said lines which followed tropical coasts, subject to monsoons, were encrusted with salt all the time. Iron had to be replaced by teak, and owing to the rapid corrosion of iron wire 400-lb. copper-wire was used. Copper-clad steel wire had been tried, but its life was less than three months. Washing was the best way to get rid of the salt; oiling seemed to increase the trouble. In a hill country other extremes were met; it was very dry, but owing to the contour of the land long spans were necessary, eight poles to the mile, and a wire spacing of 24 in. vertically. Transportation facilities affected the type of pole used; he had used Hamilton steel poles, and found old railway rail poles cheaper locally than any others. One difficulty in the introduction of new things in native country was the local jealousy; if a new instrument was installed for a subscriber all the other instruments developed mysterious faults and would have to be replaced. He had tried many varieties of enamelled wire, and in every case it broke down in a few weeks.

Mr. H. Laws Webb said it was idle to discuss the type of central office equipment if they did not know the number of subscribers and probable growth of the system. Troubles were due to the climate, to neglect of standard practice, and to the subordinate position of the telephone, owing to its being under Government control. Many difficulties would be overcome by using aerial cable, and this was nearly as cheap in the case of several wires as open lines. Steel cased instruments might be used. He asked whether the author had noted rough usage of the apparatus, and suggested that ignorance of the subscribers was due to neglect in not educating them. In Constantinople they were rather surprised to find that Mahommedan girls had offered to be operators. He believed that glass insulators were largely used in the States.

Mr. G. H. Nash thought that every engineer in the tropics formed his own opinion because there was no central point of information. There were hundreds of questions involved in design, to which answers were required by the manufacturers.

Mr. Walker considered that microphones should be damp-proof in all cases, as the diaphragms got damp and dull. Aerial cable was eminently suitable for long-distance work, and almost as cheap as open circuits. Oil in insulators got coated with dust, and oil insulators were no better than double-petticoated insulators in India.

Mr. H. Harrison said they were getting over the difficulty of evenly coating enamelled wire, and such wire, silk-coated and impregnated, was being used in telephone instruments with success.

Mr. Semby said he believed in metal casing for instruments, but care had to be used to avoid rust. Fibre, ebonite and hard rubber insulation gave trouble in the tropics; the receiver should have a metal cap; and all pole pieces should be lacquered to prevent rust from touching the diaphragm.

The author, in replying, said the paper referred to really tropical countries, such as Uganda, the Malay States, &c., which were forest regions. In no case were the switchboards really comparable in size with English boards; the largest would be for 1,500 lines, and the usual size—say, 500 or 600 lines. This made all the difference in the choice of system, and perhaps this condition had not been made clear. Mr. Alexander Siemens said that for the Indo-European telegraph lines iron poles were used, and to protect them from wandering camels a trench was dug round the base of the pole and the excavated material heaped up in conical form round the pole in the centre; this practice was also followed in the Soudan.

## CORRECTING ERRORS IN POWER MEASUREMENT BY THE TWO-WATTMETER METHOD.

The extensive and ever-extending use of three-phase current renders its correct measurement by commercial instruments a matter of great importance. Improvements in wattmeter and watt-hour meter construction and testing have been such that errors of instrument-law and calibration are easily kept within narrow limits prescribed by statute and the needs of practice. Where, as is usually the case, a two-element meter is used to measure three-phase power by the two-wattmeter method, incorrect connections are frequently made, and these, if undetected, introduce errors far in excess of those dependent on inherent defects in the instrument itself. The increasing energy demand of industrial consumers and the extending use of high-tension distribution combine to increase the risk of mistaken connections, for both current and pressure transformers are used between high-tension, heavy current networks and three-phase meters, and in a circuit, as shown in fig. 1, there are no fewer than 27 possible permutations of meter connections, only one of which yields accurate readings under all conditions. As shown by the subjoined table and the curves in fig. 3, there are 10 permutations which yield correct meter readings at one particular power factor, and the danger is that a wireman who makes some mistake in connections, evident by the faulty running of the meter, may then commence to interchange leads (instead of tracing all leads back to the mains), and thus hit on a permutation which gives approximately or even absolutely correct readings (within the limits of instrument error) at the particular power factor of the load tested, while leading to very erroneous readings at other power factors. The connections

| Permutation. | Pressure phase connected to terminal (fig. 1). | | | Direction of flow in current coil. | | Ratio R (actual/true reading). |
|---|---|---|---|---|---|---|
| | *a* | *b* | *c* | Phase. *a* | Phase. *b* | |
| I — 1 | | | | + | + | 1 |
| — 2 | *a* | *b* | *c* | — | + | $-(\tan\phi)/\sqrt{3}$ |
| — 3 | | | | + | — | $+(\tan\phi)/\sqrt{3}$ |
| — 4 | | | | — | — | $-1$ |
| — 5 | — | *b* | *c* | + | + | $\frac{1}{2}-(\tan\phi)/2\sqrt{3}$ |
| — 6 | *a* | — | *c* | + | + | $\frac{1}{2}+(\tan\phi)/2\sqrt{3}$ |
| — 7 | *a* | *b* | — | + | + | $\frac{1}{2}$ |
| II — 1 | | | | + | + | 0 |
| — 2 | *b* | *a* | *c* | — | + | $-2(\tan\phi)/\sqrt{3}$ |
| — 3 | | | | + | — | $+2(\tan\phi)/\sqrt{3}$ |
| — 4 | | | | — | — | 0 |
| III — 1 | | | | + | + | 0 |
| — 2 | *c* | *b* | *a* | — | + | $-1+(\tan\phi)/\sqrt{3}$ |
| — 3 | | | | + | — | $-(1+(\tan\phi)/\sqrt{3})$ |
| — 4 | | | | — | — | 0 |
| IV — 1 | | | | + | + | 0 |
| — 2 | *a* | *c* | *b* | — | + | $-(1-(\tan\phi)/\sqrt{3})$ |
| — 3 | | | | + | — | $1-(\tan\phi)/\sqrt{3}$ |
| — 4 | | | | — | — | 0 |
| V — 1 | | | | + | + | $-(\frac{1}{2}+(\tan\phi)\sqrt{3}/2)$ |
| — 2 | *c* | *a* | *b* | — | + | $-(\frac{1}{2}-(\tan\phi)/2\sqrt{3})$ |
| — 3 | | | | + | — | $\frac{1}{2}-(\tan\phi)/2\sqrt{3}$ |
| — 4 | | | | — | — | $\frac{1}{2}+(\tan\phi)\sqrt{3}/2$ |
| VI — 1 | | | | + | + | $-(\frac{1}{2}-(\tan\phi)\sqrt{3}/2)$ |
| — 2 | *b* | *c* | *a* | — | + | $\frac{1}{2}+(\tan\phi)/2\sqrt{3}$ |
| — 3 | | | | + | — | $-(\frac{1}{2}+(\tan\phi)/2\sqrt{3})$ |
| — 4 | | | | — | — | $\frac{1}{2}-(\tan\phi)\sqrt{3}/2$ |

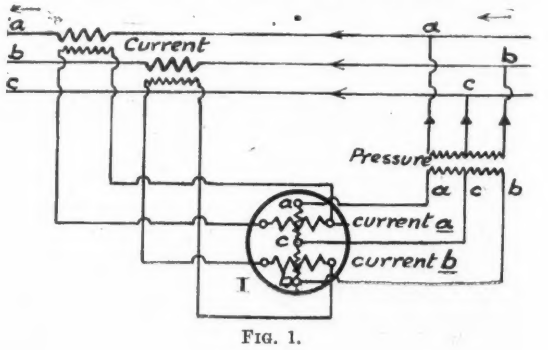


Fig. 1.

shown in fig. 1, and these alone, are correct for a double-element three-phase meter using current and pressure transformers. With correct pressure connections, and with each of the five incorrect permutations of pressure connections shown in fig. 2 (II—VI), there are four possible arrangements of the current connections, viz.: Correct; phase *a* reversed; phase *b* reversed; both *a* and *b* reversed. In the table and fig. 3, those three cases are also taken into consideration in which, the pressure connections being correct, each pressure phase in turn is broken.

With correct meter connections, and assuming (what is sensibly the case in practice) that load and pressure are balanced between phases, the meter reading is proportional to the product $\sqrt{3}\,\mathrm{I}\,\mathrm{E}\cos\phi$ —where I and E = effective current and pressure per phase and $\cos\phi$ = power factor of demand. The ratio R of the actual

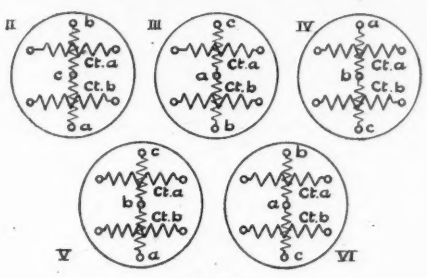


Fig. 2.

reading to the true reading in each of the 27 permutations specified above, is shown in the foregoing table.* In columns 2, 3 and 4 are shown which pressure phases are actually connected to the terminals which should carry phases *a*, *b*, *c*.

Columns 5 and 6 indicate the direction of current flow in current coils, phase *a* and *b*, + denoting correct and — denoting reversed flow.

Values of R for various values of $\cos\phi$ are shown by the curves in fig. 3, the key numerals attached to which correspond to those in the above table. If the meter reading is at all times zero (as in permutation II, III, IV, cases 1 and 4), or if the reading is at all times negative (as in cases I—2, 4; II—2; III—3; V—1; and VI—3), the fact that the meter connections are wrong is at once

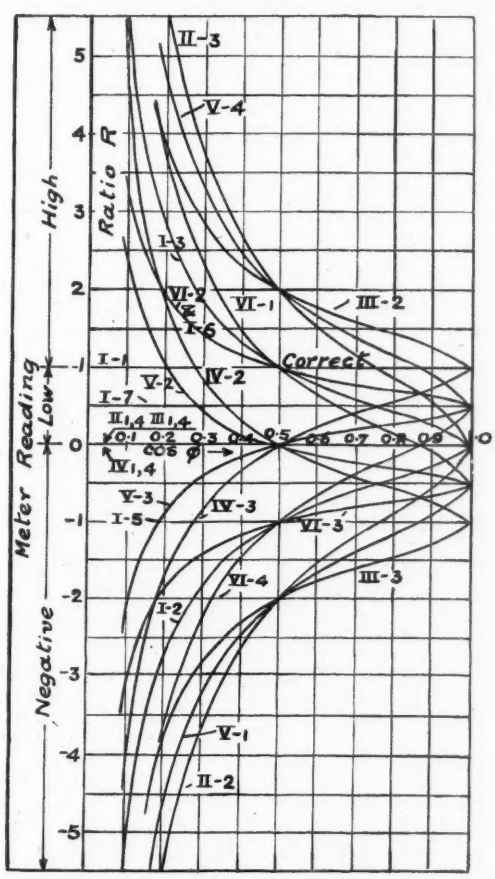


Fig. 3.

obvious, but there remain 14 permutations under which the meter runs in the correct direction but at incorrect speed. In the four cases I—5, I—7, V—3 and VI—4, the reading is incorrect at all power factors, hence the mistake is at once disclosed by comparing the meter reading with that of a standard instrument. In the 10 remaining cases, however, R = 1 at a certain power factor which is: 0·2 in case V—2; 0·28 in case IV—2; 0·5 in cases I—3, 6; VI—1, 2; 0·76 in case II—3; 0·87 in case V—4; and 1·0 in cases III—2 and IV—3. At all other power factors the reading differs from that of the standard meter, hence, by testing at say 1·0 and 0·5 power factor, mistaken connections will inevitably be detected.

When the load power factor is approximately known, the curves in fig. 3 enable at least approximate correction to be made in the actual reading of a meter found to be connected incorrectly after it has been in service for some time. At least the incorrect indication can be made a basis for payment by agreement. In many cases the value of R, during comparison with a standard meter, gives a clue to the mistake made in the connections, but in all cases of doubt the latter must be traced and checked throughout. Mere trials of various interpositions of leads may yield fortuitous and misleading accuracy over a restricted range of power factors.

* See also *Schweiz. Elek. Verein Bulletin.*

## RUSSIAN CUSTOMS DUTIES ON ELECTRO-TECHNICAL PRODUCTS AND ON THEIR RAW MATERIALS.

Until now, says an article in the Russian Government Gazette, the Russian electrotechnical industry has mostly used foreign machines, apparatus and materials. Germany has been the principal furnisher of these to Russia owing to her (Germany's) highly developed and intensely specialised industry. For the moment the importation movement from Germany is stopped, and Russia is experiencing a great shortage in many articles to which the country has become accustomed, but the production of which was not effected at all in the country, or was only in the primitive stages. There is a widely spread idea that many of the products of the electrotechnical industry are not produced in Russia because of the existing Customs tariff. Consequently it will be interesting to explain in what degree the action of the existing tariff which was introduced on February 16-29th, 1906, has been effective, whether on the importation of foreign products, chiefly from Germany, or on the corresponding production of such products in Russia.

Taking the electrotechnical industry comprehensively, it must be admitted that some of its branches are firmly established in Russia, and quite satisfactorily supply the demand, whilst others, if established, only partially supply the market, and the balance wanted is made good by a more of less important importation. Of the goods the production of which is firmly established Russian industry, we have—

1. Iron and copper wire, conductors and cables.
2. Electric accumulators.
3. Telephone and telegraph apparatus.
4. Insulating materials, &c.—largely porcelain goods.

Without dwelling on the production of iron wire which is usually employed only for telegraph and telephone lines, and is made exclusively in Russia, it is not without interest to observe the relative extent of the importation and of the inland production of the goods named.

| | Imported. Poods. | Imported. Roubles. | Made in Russia. Poods. | Made in Russia. Roubles. | Duty. Roubles per pood. | Per cent. of duty to value. |
|---|---|---|---|---|---|---|
| Copper wire ... | 19,200 | 339,000 | 158,000 | 1,707,000 | 7 r. 35 c.<br>11 r. 85 c. | 43 |
| Conductors, various | 6,800 | 318,000 | 142,000 | 3,460,000 | 16 r. 20 c.<br>17 r. 70 c. | 45 |
| Electric cables ... | 9,500 | 101,000 | 427,000 | 4,960,000 | 6 r. 70 c. | 50·3 |
| Electric accumulators ... ... | 1,600 | 46,000 | 193,000 | 1,673,000 | 9 r. | 30·6 |
| Telegraph and telephone apparatus | 5,900 | 178,000 | — | 4,367,000 | 9 r. | 25·8 |

The principal materials used in the production of the goods named in the above table are copper, lead, and brass. The duty on copper bars is 5 roubles per pood, and the average price abroad in 1912 was 11 roubles per pood, *i.e.*, 45 per cent. The duty on lead is 70 copecks per pood. The average price of lead abroad was 2 roubles 90 copecks per pood, *i.e.*, the duty equals 25 per cent. of the cost. The duty on brass depends on the composition of its manufacture, and ranges between 5 roubles and 7 roubles 10 copecks per pood; and it works out at about 45 per cent. of the cost, like the copper duty. The following tables show the duty on the raw material to be about the same as on the finished article per pood:—

| | Duty on material. | Per cent. of cost. | Duty on finished product. | Per cent. of cost. |
|---|---|---|---|---|
| Copper wire... | 5 roubles | 45 | 7 r. 35 c.—11 r. 85 c. | 43 |
| Conductors, various ... | 5 „ | 45 | 16 r. 20 c.—17 r. 70 c. | 45 |
| Electric cables: | | | | |
| Copper ... | 5 „ | 45 | 6 roubles 70 copecks | 50 3 |
| Lead ... | 70 copecks | 25 | — | — |
| Electric accumulators ... | 70 „ | 25 | 9 roubles | 30·6 |
| Telegraph and telephone apparatus ... | 5 r.—7 r. 10 c. | 45 | 9 roubles | 25·8 |

How the furnishers of goods adjust their prices to the cost of corresponding imported goods is shown with regard to copper. The average price of electrolytic copper abroad was 11 roubles per pood. In Russia the price of Russian produced electrolytic copper was 16 roubles per pood; the duty is 5 roubles per pood. Brass again, which is sold only in rods or bars and sheets, is usually dearer than pure copper. Thus, the price of average brass in 1912 was 17 roubles 36 copecks per pood, which, with a duty of 6 roubles per pood, gives us the cost of brass as 11 roubles 36 copecks per pood.

It is obvious that foreign factories have their copper and brass much cheaper than the Russian factories have them, the difference being just the amount of the Customs duty. The conclusion naturally is that we should reduce the duty on the raw material and increase the duty on the finished product in order to encourage home industry.

The foregoing shows the producers of the crude and the finished products to have opposing interests. A high tariff means high prices; but in any case it stimulates the production. Efforts must be directed to establishing a home industry built on raw material of home production. The working of the tariff is shown in connection with copper as follows:—

By the tariff of 1891 copper paid 3 roubles 75 copecks per pood. Whilst the tariff endured—till 1903—the production of copper in Russia increased when the price of copper reached 12 roubles 95 copecks per pood, and decreased as soon as the cost of copper in Russia had to be reduced below this level as a result of reduced prices abroad.

Data on existing Russian copper deposits showed that the production of copper would grow with the price of the metal no lower than that named. The progress of the copper-producing industry in Russia after the introduction of the tariff of 5 roubles per pood in 1906 is seen in the following table:—

| Year. | Poods. | Year. | Poods. |
|---|---|---|---|
| 1903 ... | 564,000 | 1908 ... | 1,033,000 |
| 1904 ... | 600,000 | 1909 ... | 1,334,000 |
| 1905 ... | 519,000 | 1910 ... | 1,378,000 |
| 1906 ... | 571,000 | 1911 ... | 1,564,000 |
| 1907 ... | 875,000 | 1912 ... | 2,047,000 |

The quantity of copper imported is much lower than that of the national production; thus in 1911, the copper imported amounted to 447,000 poods, and in 1912 to 429,000 poods.

As to lead, whether for cables or accumulators, it paid 37·5 copecks per pood by the 1891 tariff; but by the 1906 tariff, now in force, it pays 70 copecks per pood. But neither tariff has seriously stimulated the home production of lead. When the tariff was 37·5 copecks per pood the importation of lead rose from 1,880,000 poods in 1900 to 2,899,000 poods in 1903, and fell back to 2,468,000 poods, and rose to 2,879,000 poods, in 1904 and 1905 respectively. Under the 70 copecks per pood duty the importation rose from 1,304,000 pood level, to which it had fallen in 1906, to 3,099,000 poods in 1910, fell to 2,537,000 poods in 1911, rising again to 2,722,000 poods in 1912.

If we remember that in 1912 Russia produced only 82,121 poods of lead, notwithstanding the abundant deposits of lead and silver-lead ore in the country, the ineffectiveness of the duties imposed becomes obvious. It is proposed to raise the import duty to 1 rouble 10 copecks per pood. Further, the Customs duty does not sufficiently protect the finer wires and conductors; so, bearing in mind the prices of raw materials, we arrive at the following Table of duties:—

| | Existing duty per pood. | Proposed duty per pood. |
|---|---|---|
| Copper-wire from 12 mm. to the smallest gauge | 7 r. 35 c.—11 r. 85 c. | 8 r.—14 r. |
| Conductors, various ... | 16 r. 20 c.—17 r. 70 c. | 16 r. 20 c.—20 r. |
| Electric cables ... ... | 6 r. 70 c. | 7 r. 10 c. |
| Electric accumulators ... | 9 roubles | 14 roubles |
| Telegraph and telephone apparatus ... ... | 9 roubles | 30 roubles |

The consumers' interests in the matter of reduction in price must be found in competition inside the country. The article holds out little hope of lower values for raw materials. But it is different with finished products, such as, for example, cables and accumulators. The existing cable works in Russia are syndicated under the name of "Elektroprovod," the leading house being the Russian United Cable Factories, which is the largest cable and conductor-producing concern in Russia. Unfortunately with the lion's share of the business, it cannot be called Russian. It exists on German capital. The production of accumulators is similarly circumstanced. It has been monopolised recently by the Russian Tudor Accumulator Factories—a German concern that dictates the prices of accumulators on the Russian market. Therefore every new accumulator factory is welcomed—such as the Morgulius, of Odessa, and the Recks, of Petrograd. Government orders should be given in preference to Russian—and certainly to non-German—houses.

Another series of electrotechnical goods, the production of which has not been sufficiently established in the country, is listed in the following table. These used to be imported, mostly from Germany, either complete or in parts, to be assembled in Russian factories, founded on German capital.

Respecting dynamo machines, electro-motors and transformers made in Russia, classified particulars have not been received, and in the sum of 12,000,000 roubles are included parts of the respective items and discharge mechanisms. The term "*none*," in the table, means hardly any, if any at all. It has been difficult to estimate an average per cent. of duty for raw materials and finished products. Copper averages 9 per cent. to 16 per cent. in all machines; in transformers it is 20 per cent. to 30 per cent. In view of the numerous other constituents, it becomes almost impossible to estimate the part played by each.

1912.

| | Imported. Poods. | Imported. Roubles. | Made in Russia. Poods. | Made in Russia. Roubles. | Duty per pood. | Average per cent. on value. |
|---|---|---|---|---|---|---|
| Dynamo machines and electro-motors of all kinds .. .. | 247,000 | 5,883,000 | | | 8 r. 50 c. | 32·9 |
| Electric transformers .. .. | 25,000 | 493,000 | | | 8 r. 50 c. | 38·5 |
| | 272,000 | 6,376,000 | | | | |
| Parts of dynamo machines, electro motors and transformers, armatures, commutators, frames, &c... .. .. | 18,000 | 360,000 | 950,000 | 12,000,00 | 8 r. 50 c. frames, 13 r. 75 c. armatures and commutators, 17·50 armatures. | 36·6 |
| Electric switches, fuses, rheostats, bells, signal fittings, &c. .. | 140,000 | 3,860,000 | none | none | 9 r. | 30 7 |
| Electrical measuring apparatus .. | 26,000 | 1,189,000 | none | none | 9 r. | 27 |
| Electrical incandescent lamps .. | 90,000 | — | carbon—2,186,000 | 335,000 | 30 r. | 30 |
| Units .. .. | 15,500,000 | 3,260,000 | metal—525,000 | 192,000 | 65 r. | |

Therefore, the most correct measure of duty is obtained by a comparison of the cost of these goods with that of corresponding foreign, and especially German-made, manufactures. This shows that the existing duty of 8 roubles 50 copecks per pood is sufficient protection for the production of high-power dynamo machines and electromotors, in which cast-iron, iron and steel are largely used, but scarcely protects at all the production of small (20 pood) dynamo machines, electromotors, and transformers; therefore, the duty on these should be increased.

The production of electric switches, keys, fuses, sockets, rheostats, bells, &c., it has proved impossible hitherto to establish in Russia. The duty of 9 roubles per pood is not high enough.

Any production there is of electrical measuring apparatus in Russia is on a very small scale in Petrograd and Warsaw. It is calculated that the cost of production of the simplest types of measuring instruments is about 180 roubles per pood against 150 roubles in Germany; therefore, an import duty of 30 roubles per pood is required on these goods.

There are now two duties on electric incandescent lamps, 30 roubles per pood with carbon filaments, and 65 roubles per pood with metallic filaments. These rates are sufficient, making 6 copecks each on carbon-filament lamps and 13 on metallic.

The writer of the article, Prof. A. Kuznetzoff, here furnishes a table of the before-mentioned goods, showing the importation or protective duty at present levied on them respectively, and the duty that should be levied in order to ensure efficient protection.

| | Existing tariff per pood. | Proposed tariff per pood. |
|---|---|---|
| Dynamo machines and electric motors—all kinds:— | | |
| Less than 20 poods weight | 8 r. 50 c. | 12 roubles |
| Over " " " | | 8 r. 50 c. |
| Electric transformers | | 12 roubles |
| Parts of dynamo machines, electric motors and transformers, armatures ... | 17 r. 70 c. | 17 r. 70 c. |
| Armatures and commutators | 12 r. 75 c. | 12 r. 75 c. |
| Frames, partly copper:— | | |
| Less than 20 poods weight | 8 r. 50 c. | 12 roubles |
| Over " " " | | 8 r. 50 c. |
| Switches, keys, fuses, lightning conductors, dischargers, sockets, rheostats, insulators, heating apparatus, arc lamps ... ... ... | 9 roubles | 15 roubles |
| Electric measuring instruments ... ... ... | 9 roubles | 30 roubles |
| Electric incandescent lamps with carbon filaments | 30 r. with case<br>60 r. without case | 30 roubles<br>60 roubles |
| Electric incandescent lamps with metallic filaments | — | 65 r. with case<br>90 r. without case |

The writer concludes his article with the observation that higher duties alone will not necessarily create the desired industries in Russia. If not accompanied by a series of practical measures, which he enumerates, the result, he says, may simply be to make the products dearer in Russia.

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**Prices Advance.**—The Sterling Telephone and Electric Co., Ltd., of 210-212, Tottenham Court Road, London, W., announce an advance of 10 per cent. in most of the prices given in the ninth edition of their catalogue and in current publications.

# MAIN-LINE SIGNALLING ON RAILWAYS.

By W. C. ACFIELD.

(*Abstract of paper read before* The Institution of Electrical Engineers *at Birmingham, March 31st,* 1915.)

The object of the system of block telegraph signalling is to prevent more than one train being in the section between two block signal-boxes on the same line at the same time, thus providing an adequate interval of space between following trains.

Prior to 1875 the block telegraph system and interlocking of points and signal appliances were worked independently of one another, but a combined lock and block system was introduced which rendered it impossible for a signalman to accept a second train until an electric treadle, operated by the passing of a train over the railway, unlocked the block instrument in the train-on-line position.

There are certain limitations to its adoption, as sufficient elasticity cannot be obtained in cases where passenger, goods, and mineral traffic are concerned. In goods and mineral working it is not necessary to have so large a margin between trains as in passenger-train working.

To enable closer working to be carried out a mechanical arrangement is provided, viz., the cancel key, in the use of which there is unfortunately no check upon the signalman. By injudicious use of this key several serious collisions have occurred. This is the weak spot in a lock and block system.

The treadles in use to-day are of the mercury type, which are far preferable to the old form of rubbing contact. The mercury is contained in a box or chamber, and is set in motion by the deflection of the rail to which the treadle is attached.

The interlocking block is a form of lock and block in use to a large extent on the Midland Railway (which railway it is the author's privilege to serve), and furnishes the necessary elasticity for passenger and goods traffic. The instrument used is known as the rotary block; the handle stands normally vertical in the "blocked position," and to give the "line clear" and "train on line" indications is moved in a clockwise direction. There is a ratchet movement in the instrument to prevent the handle being turned in a reverse direction, and this prevents a signal being given a second time unless the handle has been rotated to both the "line clear" and "train on line" positions.

"Line clear" being given removes the electric lock on the starting signal in the rear section, and "train on line" being given drops the said lock ready to fall into position again when the starting-signal lever in the rear is placed to danger. After "line clear" has been given by the first movement, the handle is then turned to the "train on line" position and becomes locked in that position so that it cannot be moved either forward or backward until a releasing treadle, fixed on the railway inside the home signal, has been operated by the accepted train, after which the handle is free to be turned to its normal and vertical position.

To prevent the possibility of "line clear" being given for a train to approach from the rear section whilst the home signal is at "clear," a lock is provided in the block instrument, and a switch on the home-signal lever, which ensures the home signal being at danger before the handle of the instrument can be turned from the blocked or normal position. With this in combination with rotation mechanical locking on the home and starting, or shunting signals, the signalman is compelled to go through the operations necessary for passing a train through the section, thereby making certain that the starting signal if once lowered must be returned to the danger position before the home signal can be used a second time.

The rotation locking referred to provides that the home signal pulled over and replaced becomes locked until the starting or shunting signals, where the latter exist, have been pulled over and replaced; and upon the completion of this operation the starting signal is once more automatically electrically locked by the advance section, and is only released by "line clear" being given from the advance section as before described.

As it is necessary to provide means whereby the signalman can wipe out one or other of the block indications, press-buttons are provided on the instruments in the advance section and the rear section; and it is only by the co-operation of the two signalmen pressing their respective buttons simultaneously that "line clear" can be cancelled. The action of the two signalmen lifts out the ratchet lock, and enables the handle to be turned in a backward direction to "line blocked." Even this operation cannot be performed unless the starting signal in the rear is at danger, and it thus affords additional safety in working.

The cancelling of "train on line," which may be necessary owing to an on-coming train unexpectedly having to be shunted in the rear section, after permission has been given for it to leave that section, or on account of the treadle having failed to release the block instrument, is quite a different problem. To prevent the cancel being used without a record being made, it is masked by a glass, which has to be broken before the cancel button can be used.

It is the practice now to provide electric repeaters more generally to distant signals, irrespective of the facility with which the latter can be seen, in order to give the signalman an indication of the working of the signal. Home, starting, and other signals are also electrically repeated where they are out of sight of the signalman. These electric repeaters are preferably of the 3-position type, showing "on," "off," and "fault." Where signal lights cannot be seen by the signalman at night-time light indicators, electrically operated on the pyrometer system by the expansion bar placed over the flame of a signal lamp, are also provided in signal-boxes, but are not at the present time generally adopted.

Mr. A. T. Blackall has mentioned a device for interlocking the distant signal with the block telegraph system by making use of the electric repeater circuit; this ensures that the distant signal must have gone to the danger position after the passing of one train and before the acceptance of another.

Train stops for emergency purposes have been suggested by the Board of Trade as a means of arresting trains running past signals at danger. It is comparatively easy to provide them on electrified railways where the speed does not exceed 40 miles per hour, but in the case of steam railways, or even electrified railways where the speed may be anything from 40 to 80 miles per hour, it becomes increasingly difficult to design any appliance of this type that will stand the shock of impact, and at the same time meet with the requirements of express traffic working. No known automatic train-control apparatus of the mechanical type can be considered to be satisfactory.

The author suggests that a cab-signalling device is the solution of the problem; but it is considered undesirable for any indication beyond an audible signal to be given to the driver.

Probably one of the most important appliances introduced into railway signalling in the past few years is the system of track-circuiting the lines of railways, the use of which has enabled innumerable difficulties and problems to be solved, and gives very adequate protection to traffic working generally. It is used not only in automatic and power signalling, but also with very great advantage in manual systems of interlocking, by which it is possible not only to utilise the running lines to perform the indication of the presence of trains and vehicles, but to safeguard such trains by operating electric locking on signals, and also to operate electrically signals in automatic and semi-automatic systems on such sections of railways over which track circuit extends.

The essential feature is a section of track insulated at each end from adjoining sections of the track, each rail in the section being connected together by bond wires for the purpose of making a continuous conductor from one end of the section to the other. At one end of the insulated track section a battery is provided, the positive terminal being connected to one rail and the negative terminal to the other. At the entering end of the section a relay is connected to the rails in a similar manner; thus a path is given from the battery along the rails on one side, through the relay and back through the rails on the opposite side to the battery, and by such connection the relay is continuously energised so long as the track is unoccupied. The presence of a pair of wheels or a train in the section short-circuits the battery, causing the relay armature to drop. A broken rail will open the circuit and de-energise the relay, and the fact that the track circuit operates on the closed-circuit principle renders it very reliable, as any failure is on the side of safety. The relay armature is attracted on the passage of the weak current (necessary only for its operation) of the track circuit, which operates an indicator or electric lock, or controls the motor for working a signal. The armature carries a number of contacts which can be made to close as many different local circuits as desired. The relay, as constructed to-day, consists of very few parts that can get out of order, is easy of adjustment, and although placed in a case at the side of, or between, running lines of railway, is not influenced by the vibration caused by passing trains.

The type of insulated joint used on the Midland Railway is shown in fig. 1. The insulating material on each side of the fish-plates, between the rails, and in the bushes around the bolts, is compressed fibre, and standard-pattern fish-plates and bolts are used, so that it is possible for any platelayer to replace the insulation without any difficulty.

Fig. 1.—Midland Railway Insulated Joint.

Owing to the difficulty of applying continuous-current track-circuiting to meet all requirements, alternating-current track-circuiting has made rapid progress of late years, and now appears likely to supplant the continuous-current system in this country. The A.C. track-circuiting can be rendered absolutely immune from the effects of stray currents, even from an A.C. power supply, and in some cases is cheaper to install than continuous-current track-circuiting; moreover, it is said to be easier to maintain, especially on electrified railways.

On electrified railways the track circuits are sanctioned by the Board of Trade to supersede the locking bars on facing points, and the track circuit electrically locks the facing points

in whichever position they are set for the trains to pass over, the signal lever governing the route being electrically back-locked until the train has passed the overlap of the section, so that as long as the track circuit is occupied the points cannot be moved until the train has cleared the track.

The adoption of track-circuiting has necessitated greater co-operation between the permanent way and signalling staffs in maintenance work. The action of changing crossing and ordinary rails becomes equivalent to the disconnection of signalling arrangements, and the rules for permanent-way operations and disconnection, although practically distinct from one another in the past, now become so closely allied that one depends on the other if safety is to be maintained.

Platelayers' lorries require special attention where a track circuit exists, and before they are placed upon or run over any portion of a line that is track-circuited the permission of the signalman to whose signal-box the track circuit is connected must be obtained, owing to the fact that lorries cannot be relied upon, particularly if unloaded, to short-circuit the track so that signals are set at "danger," or to operate the electric locking on the signals.

The problems before all railway companies to-day for the prevention of accidents may be put down under the following two headings:—

(a) Protection of trains detained at home or starting signals.
(b) Prevention of drivers running past signals at danger.

The author suggests that they can be met by appliances such as are now being installed on the Midland Railway.

*Protection of trains detained at home signals.*—A rotary interlocking block is provided between the home signal of one section and the starting signal in the rear, the latter signal being electrically released by the pegging of "line clear." After "train on line" has been pegged, the block instrument remains locked in the train-on-line position until the train accepted has passed the home signal and has operated an electric treadle ahead of such signal, the operation of which by the train frees the block instrument, as described earlier in this paper in lock and block systems. This appliance is used on the most important lines, but in cases of less important lines a "train waiting" arrangement is used, as described later.

Another arrangement is used where trains are detained at home signals out of sight of the signalman. In this case a short length of track circuit is provided, outside the home signal, which indicates the presence of a train and holds the block indicator (for the section thus occupied) in a train-on-line position until the train has passed off the track-circuited line.

*Protection of trains detained at starting signals.*—The whole length of the line between the home and starting signals is track-circuited, and when occupied not only gives a visual indication of the condition of the line to the signalman, but also electrically locks the home signal or signals leading on to that line, thus preventing the signal being used again until the track is clear. The problem of track circuits for this function becomes more complex where junctions occur. For every junction or additional junction between home and starting signals, the running lines must be subdivided into separate track circuits in order to give the necessary freedom in traffic working without overlocking the signals for parallel routes. According to the subdivisions of the tracks the various signals are locked by one or more track circuits; in some cases a signal being locked by as many as three and four tracks.

Cases of less important lines are met by providing a treadle ahead of the starting signal and an electric lock on the home signal, so that after the home signal has been lowered and replaced to danger it becomes locked in its normal position until the treadle ahead of the starting signal has been operated. Special mechanical locking is provided on the levers working these signals so that it is necessary for the home signal to be restored to danger before the starting signal is replaced; and similarly the starting signal has to be replaced to danger before the home signal can be used again. This arrangement, in conjunction with the interlocking rotary block, ensures the signals being at danger before another train can be accepted on the block instrument.

*Train-waiting arrangement.*—This is an audible and visual system, and enables a fireman to inform the signalman that his train is waiting at a signal. A plunger and an electric horn are fixed on a cast-iron column near the signal, and, on the arrival of a train at the signal, the fireman alights, presses the plunger, and in so doing operates an audible buzzer in the signal-box and causes an indicator to show "train waiting." In addition, the block instruments are locked, and the needle turned to the train-on-line position, no matter what indication was there before. The electric horn at the signal denotes to the fireman that these operations have been carried out. The signalman cannot remove the train-on-line indication from his or the rear-box block instrument until he has pegged his instrument to "train on line" and then pulled over and replaced the home signal to danger. Some companies provide illuminated lamps where such apparatus is installed, but from experience these have not been found necessary.

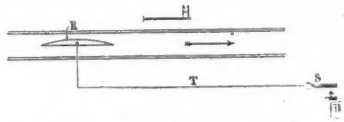
With the introduction of appliances for the protection of trains detained at signals, it has been found necessary to provide some distinctive indication on home and starting signals at which the carrying out of Rule 55 is dispensed with. A diamond-shaped sign indicates that the train standing at the signal is protected by interlocking rotary block, track-circuit, or treadle arrangement. A D-shaped sign indicates that means are provided for trainmen to protect the train by pressing the plunger of the train-waiting appliance fixed on the ground at the signal at which the train is detained.

About 1,200 signals on the Midland Railway are provided with these signs. Other companies are adopting them, and it is hoped that the practice will become universal.

*Prevention of drivers running past signals at danger.*—Some of the most serious accidents in recent years have been brought about by drivers disregarding signals, even in perfectly clear weather.

Detonator-placing machines are now used to a very considerable extent to enable the signalman to place detonators on the line to which the signals apply. About 600 of these appliances are in use on the Midland Railway and have been the means of effectively arresting runaway trains. The times, however, call for a more effective and permanent appliance that will be in operation at all times and for all trains.

There are serious obstacles to be overcome, the first of these being the general adoption by all railways of a uniform means of warning drivers that they are approaching the danger zone. From practical experience it has been found impossible to obtain satisfactory results from any apparatus that relies on



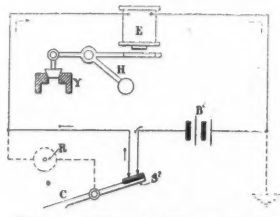

R, Ramp; T, Telegraph wire; S, Switch (operated by lever working signal); B, Battery.
Note.—Battery connected to ramp only when signal is "off."

Fig. 2.—Line Circuit.

the operation of its parts by impact. It is not considered desirable to give any visual indication to drivers. The author suggests that of all appliances yet introduced, automatic train control and an audible signal go nearest to meeting the before-mentioned requirements.

*Automatic train control and audible signal.*—The primary object of this system (figs. 2 and 3) is to give an audible warning on the engine when the train is approaching a distant signal which is at danger, and, in the event of this warning being disregarded by the driver, automatically to apply the brakes so as to ensure the train being pulled up before it reaches the home signal. Another distinctive audible signal is also given on the engine when the distant signal is in the clear position. The value of the latter audible signal is that it facilitates the running of trains when the semaphore signals cannot be seen during fogs or snowstorms. The audible signals given are the sounding of a siren indicating stop, and the ringing of a bell indicating proceed. The point at which the audible signals are given is usually about 400 yards before the distant signal is reached.

This apparatus involves a metal ramp, about 60 ft. in length, fixed in the centre of the 4-ft. way of the railway, and a contact shoe on the engine, which engages with the ramp to operate the audible signals. The ramp is slightly staggered in order to reduce wear-and-tear on the shoe, and is at the highest point 4 in. about rail-level. The contact shoe is fixed in the centre line of the engine and hangs down to within 2½ in. above rail-level. It is capable of being raised vertically to the extent of 1½ inches whenever a ramp is passed over, which opens a switch attached to the contact shoe. The ramp is




R, Bell; E, Electromagnet controlling brake valve and whistle; Y, Brake valve and whistle; C, Contact Shoe; S², Switch attached to contact Shoe; B², Battery (engine); H, Restoring handle.
Note.—Local circuit closed. Electromagnet energized, brake valve and whistle closed.

Fig. 3.—Local Engine Circuit.

connected electrically with the signal-box by means of a switch on the lever operating the distant signal, and the signalman can, when the signal is "off," connect it with a battery, so that the ramp is electrically alive; otherwise it is dead with the signal at danger. The switch on the shoe is connected with the electrically-controlled brake valve and the siren in such a way that whenever it is opened air is admitted through the siren and brake valve to the train pipe, thereby sounding the siren and applying the brakes on the train if the ramp is not electrified. Should the ramp be electrified by the signal being "off," when the train passes over it the brake valve is not released, but a bell on the engine rings instead, owing to a current picked up from the electrified ramp, the effect of which is to cut out or render inoperative the switch attached to the shoe, so that although the switch is opened it does not

release the valve admitting air through the siren to the train pipe. If there is any failure to pick up the current when the ramp is passed over, the effect on the engine is the same as though the ramp was not electrified, the brakes being applied.

This apparatus distinguishes distant signals both by day and night, gives distant signals to engine-drivers in the cabs of engines, and dispenses with fog-men at such signals.

Another advantage of this system is that ramps may be placed in any position regardless of distance at curves, bridges, tunnels, etc., and can be used on single lines in connection with electric train staff and tablet systems by certain modifications.

The problem of cab-signalling on electrified railways requires much consideration, owing to the fact that the negative rail is placed in the centre of the 4-ft. way, and consequently the ramps would have to be fixed between the negative rail and one of the running rails. There is every reason to suppose that the shoes would have to be duplicated so as to suit the reverse running of trains, both on single and double lines. The possibility of such an apparatus being affected by extraneous currents is another point that would call for special consideration.

*Railophone.*—This system, an invention of Mr. H. von Kramer, as applied for giving an automatic warning in the engine cab of the vicinity and indication of a signal, is undoubtedly designed on right lines, and may be said to mark the latest phase of electrical operation. It is primarily intended for use in connection with distant signals, with the object of giving the desired warning of the position of the signal arm and causing the train brakes to be applied automatically when occasion requires should a train overrun a signal.

Unlike the automatic train control previously mentioned, this system has no physical connection or contact with either the rolling stock or the permanent way, but is operated entirely on the wireless inductive principle, the transmission of electrical energy being between a fixed circuit on the ground and a circuit placed on the moving train.*

An experimental installation has been tested on the Midland Railway, but so far it has not been considered desirable to publish any results. It may, however, be interesting to note that a driver on approaching a distant signal receives three short warnings in quick succession by means of a compressed-air whistle fitted in the engine cab, quite irrespective of whether the signal is at danger or clear. Should the signal indicate danger, the three warning signals are followed by a fourth prolonged signal, and the brakes are automatically applied, but it is so arranged that the fourth signal and the application of the brakes take place only if a driver fails to apply the brakes in the ordinary way after the three warning signals have been received. Should the signal be in the clear position the train is allowed to proceed without interruption, but the driver is aware that he is passing a signal by the three warning signals given on the whistle.

*(To be continued.)*

## ELECTRIC COOKING.

During the discussion upon Mr. W. R. Cooper's paper on "Electric Cooking, mainly from the Consumer's Point of View," which was abstracted in our issue of March 19th, at the last meeting of the Yorkshire Local Section of the Institution of Electrical Engineers, Mr. Campion said that in regard to heating water at one farthing per unit, on the assumption that the cooking load was supplied at a halfpenny per unit there was a good case for it. He was, however, of the opinion that the central station engineers had taken a very liberal and broad view in cutting down these rates and had done their part; it was now time that the people who were making the apparatus came forward and helped. In Dewsbury the people who had cooking apparatus used about 250 units per month. They had the assessment principle in vogue, and the local authorities stipulated that when a consumer accepted this tariff he must, according to his rateable value, install a certain amount of heating or cooking apparatus; in eleven cases out of twelve the consumer installed heating apparatus. The question of outlay was a very big one indeed. In Dewsbury there were some fairly wealthy men, but they would not install apparatus at half the price suggested by Mr. Cooper in his paper. They would not mind hiring it, but they were averse to risking £12 10s. 0d. He endorsed the author's remarks about the earthing of his apparatus. With reference to the flexibles, he believed they had all found—and most of the cable manufacturers were coming to it now—that a steel wire inserted in the flexible gave a good deal more mechanical strength, and he was surprised that it did not come out better on the test. In industrial towns he believed it was being found that the big loads occurred between 10 and 11 in the morning, and they would certainly get a big cooking load when they got a good number of houses upon the mains where mid-day meals were the rule. He knew of a case where a consumer obtained the following contract with the makers in regard to the maintenance of a cooker which he had purchased :—First year's maintenance free; second year, 8s. 6d. per quarter; third, fourth and fifth years, 17s. 6d. This arrangement was satisfactory to the consumer, because he knew about what the maintenance was going to be.

Mr. Wright said he believed that although lighting and power connections were rising at a satisfactory rate, heating and cooking connections were rising at a more accelerated rate. The question of electric lighting might be taken as settled for all new houses within reach of tenants of a rental value of, say, 7s. or 8s. per week; the houses were now wired as a matter of course, because the owners realised that a house wired for electric light had a better chance of letting. It was different, however, with electric cooking, and it rested with the station engineers and electrical manufacturers of cooking plant to supply electric cooking on the same plane as electric lighting. They must not suppose that because electric cooking was progressing the gas cooking was necessarily stationary. Between 1908 and 1912 the number of gas cookers added to the mains of seventeen selected towns in England rose from 811,000 to over 1,000,000, and he had no doubt that since then the total number had risen considerably. The initial cost of electric cooking apparatus very much handicapped the more extensive adoption of that apparatus, and the novelty of electric cookers was reckoned as an experiment. From the station engineer's point of view the cooking load was well worth cultivating, as it would give him a better annual load factor and improve his diversity factor at the same time, though it would not, he thought, increase his peak load. The advantages of cleanliness, regulation of temperature, reduction of waste, etc., in electric cookers were bound to appeal strongly in their favour, but the present difficulty was the great difference in first cost of the apparatus as compared with gas or coal cooking. As soon as these became comparable he thought electric cooking would come much more extensively into domestic use and a reduction of the cost of current and maintenance would automatically follow.

Mr. Wallis said he felt that electric cooking was one of the coming things, but great difficulties of manufacture had to be overcome. It was by attention to little details that perfection would be attained.

Mr. Innes said he believed the ideal place for electric cooking was in flats. He did not think they could get many people to go in for heating water even at one farthing per unit. In his own experience the boiling of water—even tea water and for similar requirements—consumed a great deal of the total energy consumed in the house. The actual cooking was only a small proportion of the total load. Keeping food warm took a good deal of current; and if there was an Ideal boiler installed which served as a hot plate, as mentioned by the author, it did away with a good deal of the cost of current. He totally disagreed with the author's suggestion that the makers or corporations—if they were hiring-out apparatus—might go so far as to repair the apparatus free of cost, because contractors naturally looked to the maintenance to bring some return to them for their expenditure on apparatus. He doubted whether they could get the ordinary cook to keep her eye on the thermometer. He suggested the addition of an indicating lamp on every element and not simply on the main switch, because that was rather misleading. In regard to flexibles, he did not think they got nearly the trouble now that they used to get.

Mr. Lang said that apparently the author had not differentiated between wires insulated with double pure rubber and those insulated with pure rubber and vulcanised rubber. Pure rubber insulation was absolutely of no use at all in damp places or in positions where heat was likely to affect the rubbers.

Mr. Collinson said that as a contractor his difficulty was in selling the apparatus. The cost of an electric cooker was at least three times the cost of a gas cooker, and to hire-out apparatus for a house rented at from £20 to £25 he would have to make a charge of £3 per annum, whereas the Bradford Corporation would hire-out the same cooker at 10s. per annum. The whole trouble seemed to be the high initial cost. Electric cookers were not worth the money the electrical manufacturers were charging for them, but they must agree that the manufacturers had not yet been in a position to manufacture them at competitive prices.

Mr. Burnand said there was no doubt that in a good many cases earthing was deficient, and insulation was preferable to earthing in a kitchen if it could be arranged.

Mr. Moss said that if earthing the portable apparatus was carried out to its uttermost limit, instead of cheapening the cost of the apparatus it would cripple the sales. As a contractor, he maintained that so long as people sent repairs the contractors should have a fair margin of profit on the cost.

The Chairman (Mr. T. Roles) said that the heating of domestic water could be done successfully by using a large amount of electricity for heating the water as it flowed from the tap. That might be looked upon by central-station engineers as a rather drastic proposal, but he did not think it would affect the pressure on the electric supply mains as much as was generally anticipated, provided fairly large mains were laid. His experience was that screwed steel tubing, if properly carried out, formed a very good earth. There was little doubt that there was a great saving of meat by the use of electricity as compared with either coal or gas ovens.

The Author briefly replied to the points raised in the discussion.

* A full description appeared in the Electrical Review of July 5th and October 11th, 1912.

## FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

PANAMA.—H.M. Minister at Panama has recently drawn attention to the publication in the *Gaceta Oficial* of a law regulating, amongst other things, ship's manifests, invoices, and fees chargeable by Consular officers. This Act provides that all persons wishing to ship merchandise to a port in Panama open to commerce must present to the Consul of Panama at the port of shipment six copies of an invoice giving the following particulars, viz.: The name of the shipper; the place of origin; the name of the consignee; the name of the ship and port of destination; the mark, numbering class and weight of each package; together with exact details of the goods and their original prices. The charge for certification of the six copies of the invoice is 0.9 per cent. of the total net value of the invoice payable in the currency in which the invoice is made out with a minimum charge of one gold dollar. In addition to Consular fees for certifying invoices, three dollars is charged for certifying each set of bills of lading dealing with invoices of a greater value than 100 dollars, and six dollars for certifying four copies of ship's manifests for every 100 packages, and 1.20 dollars for every additional 100 or fraction thereof. The fee for a ship's manifest covering articles of iron, steel, copper, zinc, wood, tiles and similar goods, is six dollars, however large the amount of shipment. Consular officers can only certify to invoices when they refer to packages with one mark, from one shipper, consigned to one individual or company, and for one place. If invoices are not accurate or do not comply with the requirements, 5 per cent. of the value of the invoice is collected in addition to the duties; when the inaccuracies or omissions, however, are not of a general character, but refer to one or more items, only the fine is imposed on the value of the articles which have not been properly declared. The full text of the law and a translation may be seen at the Commercial Intelligence Branch, Board of Trade, 73, Basinghall Street, London, E.C.

NEW ZEALAND.—The New Zealand Customs Authorities have decided that Kelvin composite balances defined as electric testing apparatus may be imported free of duty.

RUSSIA.—With reference to a notice regarding a proposed revision of the Russian tariff which appeared in a recent issue of the Electrical Review, the Board of Trade have now received telegraphic information from H.M. Ambassador at Petrograd to the effect that an Imperial Decree which was promulgated on March 25th and came into force on the same day repeals the Decree of the 16th August, 1914, by which the Russian "conventional" rates of duty (*i.e.*, lower rates the result of Treaties) provided for in the Commercial Treaties between Russia on the one hand and Germany and Austria on the other, were temporarily maintained in force in so far as they were applicable to goods imported from Allied and neutral States. In addition, certain goods are subject to special augmented rates, and the General Tariff rates of duty in certain other goods are increased by 10 per cent. The General Tariff rates for machinery of all kinds falling under Section 167 of the Tariff are not modified. With this exception the effect of the new legislation would appear to be as set out in our previous notice. H.M. Ambassador is forwarding a translation of the Decree, and as soon as possible after its receipt the Board of Trade propose to issue a Parliamentary Return showing in detail the effect of the amendments now introduced in the Tariff.

SWEDEN.—The Swedish Government have recently prohibited the exportation of the following amongst other goods: Electro-magnetic igniting apparatus for the ignition of motors; lead ore; scrap of pig-iron and malleable iron; unmanufactured tin, also scrap tin; manufactured tin—pipes and parts of pipes, sheets and wire, also rods.

## NEW PATENTS APPLIED FOR, 1915

### (NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

4,808. "Sparking plugs and manufacture of the same." T. Crosbee & Sons, Ltd., and W. J. Spicer. March 29th.

4,812. "Electrically-heated kettles and analogous vessels." W. W. Soutter. March 29th.

4,820. "Dielectric filling, insulating, or grouting composition." R. C. Sharp. March 29th. (Complete.)

4,835. "Magneto-generator-operated telephone bell signals." S. P. Wood. March 29th.

4,849. "Apparatus for electrically detecting vibrations." F. Gottschalk. March 29th. (Complete.)

4,885. "Means for connecting electrical conduits to their fittings." F. L. Broughton. March 30th.

4,895. "Combined electric lighting and starting apparatus for motor vehicles." L. Duca, E. Naldini, C. Massavelli, & L. Bellone. March 30th. (Complete.)

4,896. "Electric switches as applied to stop-motions on textile machinery." P. Sharp. March 30th.

4,911. "Electro-magnetic switches." British Thomson-Houston Co., Ltd. March 30th. (General Electric Co., United States.)

4,912. "Transmission of sound waves." E. M. C. Tigerstedt. March 30th. (Convention date, March 30th, 1914, Germany.) (Complete.)

4,953. "Sound-magnifying appliances for telephonic and telegraphonic purposes." H. Smith. March 31st. (Convention date, April 18th, 1914, United States.) (Complete.)

4,955. "Apparatus for obtaining unidirectional electric currents from sources of alternating electric currents." E. F. Clark. March 31st.

4,967. "Emergency electric lighting system." W. Dobie. March 31st.

4,978. "Pipes and electrical conduit fittings." H. F. Joel, Sen. March 31st.

4,987. "Hot-wire alternating-current limiters." P. Wessel. March 31st. (Complete.)

4,999. "Electrical welding." W. M. Mordey. March 31st.

5,001. "Electric motor controllers." Igranic Electric Co., Ltd. March 31st. (Cutler-Hammer Manufacturing Co., United States.) (Complete.)

5,002. "Means for regulating electrical circuits." Igranic Electric Co., Ltd. March 31st. (Cutler-Hammer Manufacturing Co., United States.) (Complete.)

5,007. "Spring arrangement, especially for use in electric contact devices." Landis & Gyr Akt. Ges. March 31st. (Convention date, April 2nd, 1914, Germany.) (Complete.)

5,055. "Electric resistances." W. F. Jones. April 1st.

5,061. "Electrical circuit fittings." J. I. Hall. April 1st.

5,076. "Electric signalling systems for use on railways." J. Boot & W. E. Scourfield. April 1st.

5,079. "Dynamo-electric machines." R. Boin. April 1st. (Complete.)

5,088. "Metering in telephone systems." E. Shibko. April 1st.

5,089. "Telegraph key." Sterling Telephone & Electric Co., Ltd., and T. D. Ward-Miller. April 1st. (Complete.)

5,104. "Electric motor controllers." Igranic Electric Co., Ltd. April 1st. (Cutler-Hammer Manufacturing Co., United States.) (Complete.)

5,106. "Electric heaters." A. Mond. April 1st. (Soc. Anon. Electrocalor, Switzerland.)

5,120. "Blowing devices." Midland Electric Rotary Blowing Co., Ltd., and J. Page. April 3rd.

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

### 1914.

6,179. Railway Signalling System. M. H. Collins. March 11th.

6,421. Means or Apparatus for Indicating when the Flow of Current in an Electric Circuit is Interrupted or Varied. A. F. Berry. March 13th.

6,428. Telephone Systems. Automatic Telephone Manufacturing Co. (Automatic Electric Co.). March 13th.

6,659. Telephone Systems. T. G. Martin. (March 17th, 1913). March 16th.

6,918. Electrical Generating and Control Systems. H. J. Read. March 18th.

6,970. Silent and Balanced Electro-magnetic Step-by-step Driving or Synchronising Mechanism, particularly applicable to the Control of a System of Time-indicating Units. E. E. Craig. March 19th.

7,023. Carriers for Lamp Shades. A. R. Craddock & W. Scott. (August 12th, 1913.) March 19th.

7,513. Telephone Switches. T Green. (Cognate applications, 16,904/14 and 13,281/14.) March 25th.

8,010. Electric Switches. G. Chebrou & A. Lemp. March 30th.

8,413. Signalling in the Shafts of Mines, Tunnels and the like. J. W. Land. April 3rd.

11,229. Construction of Telephone Index or Directory Holder. H. R. Hazard. May 6th.

12,804. Electrical Egg Testers. F. du Bois. March 25th.

12,976. Electrical Switches. H. W. Cox. May 27th.

13,348. Electrically-heated Vulcanising Apparatus. W. T. Henley's Telegraph Works Co. & H. Savage. May 30th.

13,523. Telephone Exchange Systems. Western Electric Co. (F. T. Woodward, acting for Western Electric Co.). June 3rd.

13,960. Electric Wire Connection. M. E. Holdaway & B. J. Anderson. June 9th.

14,192. Process and Electric Furnace permitting the Extraction in a state of purity of Zinc from its Ores. E. F. Côté & P. R. Pierron. June 12th. (November 19th, 1913.)

16,318. Electric Circuit Interruptors. J. N. Mahoney. July 8th. (August 11th, 1913.)

18,747. Automatic Current Cut-off for Electrical Appliances. U. S. Smith. August 17th.

18,809. Pocket Electric Flash Lights. W. J. Mellersh-Jackson (Posen). August 18th.

19,878. Material for the Insulation of Electrical Conductors. W. Teggin, and London Electric Wire Co. & Smith's, Ltd. September 17th.

20,239. Electric Regulating Rheostats. L. Boothman. September 26th.

20,494. Means for Communicating on Trains. J. Rafferty. October 3rd.

22,133. Self-induction Coils for use in Duplex or Multiplex Telephone Systems. A. H. Olsson & H. B. M. Pleijel. November 6th. (November 7th, 1913.)

22,732. Means for Regulating the Speed of Electric Motors. Allmanna Svenska Elektriska Aktiebolaget. November 18th. (January 5th, 1914.)

### 1915.

2,060. Means for and Methods of Changing the Frequency of Alternating Electric Currents. A. M. Taylor. February 9th. (Divided application on 15,729/13, February 9th, 1914.)

**Electric Baggage Trucks.**—With reference to our description of the Elwell-Parker battery trucks supplied to the North-Western Railway Co., appearing on page 590 in our last issue, we are informed that the turning radius of these trucks is only 6 ft. 6 in.; they measure 7 ft. by 3 ft. 10 in., and weigh 1,900 lb. empty, being of a smaller type than those for which similar data (supplied by the agents) was given in our article. We also gather that these particular trucks are fitted with a worm drive on the back axles.